MEDICAL LIBRARY
OCT 8 1935

SERIES 3, Vol. 18, No. 10 OCTOBER, 1935

AMERICAN JOURNAL OF OPHTHALMOLOGY

CONTENTS

	Page
Original Papers	
Uveal sarcoma—malignant melanoma. Theodore L. Terry and Juanita P. Johns	903
Measurement (roentgenometry) of antero-posterior diameter of the eyeball in situ correlated with micrometer measurement following enucleation. Dewey Katz and Alfred C. Ledoux	914
Congenital and acquired deficiencies of fusion. Alfred Bielschowsky	925
Ocular complications in neuroblastoma. P. J. Leinfelder	938
Strabismus in children corrected by refraction alone. George P. Guibor	944
Bacillus pyocyaneus infection of the eye. W. W. Lanou	950
Trachoma as an endemic disease in Egypt. Farid Massoud	952
Notes, Cases, Instruments	
A simple needle for diathermy treatment of retinal detachment. Harry S. Gradle	956
A special clamp for holding lid sutures in cataract operations. Warren D. Horner	957
Society Proceedings	
Saint Louis, Philadelphia, Los Angeles, Nashville, Chicago, Memphis	959
Editorials	
The ophthalmic vitamin; The Cincinnati meeting	967
Book Notices	969
Obituaries	970
Correspondence	972
Abstract Department	973
News Items	1001

For complete table of contents see advertising page V

Copyright, 1935, Ophthalmic Publishing Company, 640 South Kingshighway, Saint Louis, Missouri

Subscription price in United States ten dollars yearly. In Canada and foreign countries twelve dollars.

Published monthly by the George Banta Publishing Company, 450 Ahnaip Street, Menasha, Wisconsin, for the Ophthalmic Publishing Company, 640 S. Kingshighway, Saint Louis, Missouri

Editorial Office: 640 S. Kingshighway, Saint Louis, Missouri

Entered as second class matter at the post office at Menasha, Wisconsin

DID YOU *See this one* MOTHER ?

● Newspapers—an anticipated daily pleasure to people in the autumn of their life. Thanks to your knowledge and the skill of optical science, old folks, with their eyes well past the peak of their efficiency, may enjoy these and the countless other things they encounter in their daily life. . . . In that respect this organization carries on where you leave off. But as your service—ours is a sacred one—that of interpreting your prescription precisely, of furnishing spectacles of unquestionable quality, that old eyes or young may see better—with greater comfort. A twenty-eight year record for quality and accuracy forms the background of experience and skill that is placed at your and your patients' command—through seventy conveniently located offices from Chicago to the Pacific Coast, which for your added protection feature Bausch & Lomb products.

RIGGS OPTICAL COMPANY

AMERICAN JOURNAL OF OPHTHALMOLOGY
VOLUME 18 OCTOBER, 1935 NUMBER 10

UVEAL SARCOMA—MALIGNANT MELANOMA

A Statistical Study of Ninety-four Cases

THEODORE L. TERRY, M.D.
AND
JUANITA P. JOHNS, M.D.
BOSTON

This is a preliminary report on statistical studies of the cases sent to the Pathological Laboratory of the Massachusetts Eye and Ear Infirmary since the year 1899. Though the total number of cases is over three hundred, this report concerns itself with ninety-four cases in which the follow-up was sufficiently complete. A comprehensive study of the age, sex, duration, diagnosis, cell type, extension of tumor, metastasis, end results, size, shape, pigmentation, necrosis, inflammation, uveitis, glaucoma, vascularized membrane of iris, separated retina, and cataract was made. From the Department of Ophthalmology, Harvard University School of Medicine and the Massachusetts Eye and Ear Infirmary. Read before the American Association for Research in Ophthalmology, at Atlantic City, June 11, 1935.

In recent years grave doubts have arisen as to the mesoblastic origin of the class of primary malignant uveal neoplasms commonly called sarcomata. In fact, Masson and others have presented strong evidence that is indicative of ectodermal origin[1]. It is preferable to avoid any name indicative of origin from a specific germinal layer. A name should also indicate some relation to melanotic pigment, since there can be little doubt that every single one of these tumors does have a tendency to produce melanin, as shown by the use of 3 4 dihydroxyphenolalanine (the active principle of the "dopa" reaction). The term Malignant Melanoma fits these qualifications better than any other name that has been applied to these tumors.

Malignant melanomata are relatively rare, being found on an average in five out of ten thousand patients who visit eye clinics[2]. It is therefore impossible for any one observer to collect and study in a uniform and detailed manner a large number of cases.

This is a preliminary statistical report concerning ninety-four cases of malignant melanomata of the ciliary body and choroid. The statistical results are open to criticisms from several points of view, though they do show certain trends. Some of the statistics may be no more than arithmetical exercises *per se*, but such a method of study of many more cases may eventually yield important information. No necropsies were obtained in any of these cases, the cause of death representing the opinion of the attending physician. Cases that were followed for less than five years and that did not terminate fatally are included only because there is no hope for further follow-up. The follow-up work was done by one of us (Johns) using a method based on the system devised by Channing W. Simmons[3].

Almost since the advent of the microscope there has been an increasing desire to classify malignant neoplasms as to the degree of malignancy. For many years the individual pathologist had indicated his views on degree of malignancy in his own descriptive terms. In 1893 Hansemann[4] suggested the drawing of a scale to represent the degree of immaturity of the cancer cell. In 1920 Broders[5] introduced a method of grading squamous-cell epithelioma of the lip. There was an attempt by various observers to apply this or similar types of grading to all malignant tumors re-

gardless of origin or class. These methods were found to be erroneous and misleading when applied to the individual case. Grading of tumors is still being studied in great detail but now with the precaution that the grading must be done on rules formulated and tested on similarly classified tumors of each particular organ. It is not considered a safe procedure yet to rely on grading for the selection of the extensiveness of the operation. It is only by study of many cases, preferably thousands, that the various points can be evaluated for determination of just what is indicative of the degree of malignancy, and what is indicative of the degree of tissue resistance. The work of Gates and Warren[6], Mills, Broders, and Caylor[7], Hueper[8], Simmons, Taylor, and Wallace[9], Greenough and Taylor[10], and many others indicates that these studies do increase our general knowledge concerning tumors.

Most authors have overemphasized the relationship of pigment in spite of the fact that Virchow[11] in 1863 correctly stressed the opinion that pigmentation was of secondary importance. E. Fuchs[12] attempted to gain some criteria for classing the uveal sarcoma into more and less malignant growths. There has been a great variation in the terminology used. All observers agree that there are spindle-cell tumors and round-cell tumors. Descriptive terms such as epithelioid sarcoma, angiosarcoma, palisade sarcoma, and so forth, have not been uniformly accepted. In 1931 Callender[13] described four or perhaps five specific types into which all primary malignant uveal neoplasms can be classified. These types are:

Spindle-cell type

"Sheets, whorls and other irregular arrangements of spindle shaped cells, with long, oval nuclei. The ends of the cells appear to terminate in fibers, so that the cells resemble fibroblasts, . . . there is no argentophile reticulum except that accompanying nutrient vessels. These spindle cell tumors can be separated into two divisions by the nuclear characteristics.

Subtype A ". . . the nucleus has a delicate, reticular structure, in which the nucleolar material is not well defined. These tumors are usually fairly heavily pigmented. . . .

Subtype B ". . . the cell has a sharply defined, deeply stained, small, round nucleolus, usually situated near the center of the nucleus, in a rather coarse nuclear network, . . . are usually lightly pigmented.

Fascicular type

The cells of this type are elongated, sometimes forming fiber-like structures, but rounded and polygonal shapes are seen. The characteristic nucleus is oval, has a distinct nucleolus, and closely resembles the nucleus of spindle-cell subtype B. The majority of the cells . . . are arranged in columns or fasciculi, the long axis of the cell being at right angles to that of the column. The cells radiate about the center of the column in a palisade arrangement, the center being a lymphatic or capillary blood vessel. . . .Pigmentation is usually very scanty.

Epithelioid type

". . . polygonal cells, usually of relatively large size, though there is considerable variation in both size and shape. The nucleus is large, round, or somewhat oval, and the nucleolus is distinct. . . . Often rather abundant argentophile reticulum is found. . . . This type varies greatly in the degree of pigmentation.

Mixed-cell type

". . . irregular mixtures of spindle and epithelioid types of cell, with occasional areas of fascicular type. . . . These tumors are usually very heavily pigmented."

From the standpoint of immaturity of cell forms one would consider the epithelioid type to be the most malignant but Callender actually found the mixed sarcoma to be the most malignant.

In the report of the American Registry of Pathology[14] in 1934, further data were given concerning these tumors which bear out the trend as found by Callender.

Callender's classification has been used in this study. Callender does not refer to the tumors containing giant cells. The significance of these giant cells is not obvious.

No detailed information is included concerning the proportion of mitotic figures seen. The presence and proportion of mitotic figures is extremely variable and in many cases could not be determined accurately because many sections were very old, faded, thick, and heavily pigmented, conditions that cannot be remedied now.

Discussion of statistics*

Age. The age distribution was entirely consistent with the findings of other observers. However, the age span in this group did not contain the extremes. Fuchs[12] reported eleven cases in the first decade of life.

Table 1

AGE AND SEX DISTRIBUTION OF CASES

Decade	Male	Female	Total	Percent
2d	4	3	7	74.
3d	6	4	10	10.6
4th	7	7	14	14.9
5th	10	10	20	21.3
6th	13	8	21	22.3
7th	3	1	4	4.3
Unknown	7	11	18	19.2
	50	44	94	100.0

Sex. Malignant melanomata occurred somewhat less frequently in women and at a relatively younger age.

Clinical diagnosis. The tumor was neither diagnosed nor even suspected in forty-two cases. In these cases the correct diagnosis would have been difficult if not impossible because of large separation of the retina, cataract, glaucoma, uveitis, or opaque cornea.

Cellular classification and grade of malignancy. The cellular classification was determined after repeated studies of more than one section. In some fourteen of the cases classification was difficult. All cases falling into Spindle types, A and B, were considered to have a good prognosis and all others were considered to have a bad prognosis. It was found by comparing the prognosis with the actual results of the follow-up that a good prognosis was given erroneously in five cases and a bad prognosis given erroneously in fourteen cases. A review of these cases resulted in a transfer of four cases to other classifications which, however, altered the results of the study very little. There are several factors which doubtless did interfere with the follow-up results (regardless of the assumption that the grade of malignancy is classifiable). Some patients, who had they lived longer might have eventually shown metastasis, died of other causes. The tumor must have been removed completely in some of the cases before metastasis had occurred. Spontaneous cure, especially through complete necrosis of the tumor, is well within the realm of possibility.

Six metastases occurred after a five-year period, four of which occurred between nine and twelve years after enucleation. From this study alone it is very evident that freedom from metastases, for the usual five-year period, is not a sufficient interval in which to determine the malignancy of malignant melanomata. In fact, other observers have noted metastasis as late as twenty-four[15] years after enucleation.

The difference between the end results in this group of cases and those of the American Registry of Pathology[14] may be due to a difference in classification of individual cases, to the fact that the total number of cases in each series is too small to give accurate trends, or to the fact that some of our cases were followed over a longer period of time thus giving greater mortality percentage. It is noteworthy that in each series no case of Spindle-cell subtype A give rise to metastasis. It is

* A tabulated report of each individual case studied in this investigation appears in the Transactions of the Association for Research in Ophthalmology, 1935.

Table 2

METASTASES

Years Followed	1	2	3	4	5	7	9	12	15	18	24	Total
Metastases	6	5	3	4	2	2	2	4				28
No Metastases	4	10	10	9	2	4	7	3	3	5	1	58
Total	10	15	13	13	4	6	9	7	3	5	1	86

Table 3

CELLULAR CLASSIFICATION AND END RESULTS

	No. of Cases	Metastases percent	Deaths from Other Causes	Death Unknown Cause	American Registry of Pathology	Metastases percent
Spindle A	6	0.0	1	2	25	0.0
Spindle B	12	5–41.5		2	44	6.8
Fascicular	8	5–41.5		1	14	21.4
Epithelioid	8	3–37.5		4	12	25.0
Mixed	31	16–51.6		7	101	36.6
Total	65*	29–41.5		16	196	23.4

* Cases followed less than five years with no metastasis are not included in this table.

also very noteworthy that the Mixed-cell type gave rise to the most metastases. The other types, Spindle B (in our series only), Fascicular, and Epithelioid showed little difference in percentage of metastases. With these points in mind it seems logical to recognize three grades of malignancy, namely:

Grade I, Spindle A

Grade II, Spindle B (?), Fascicular, and Epithelioid

Grade III, Mixed

It may be found that Spindle-cell subtype B may belong in Grade I. In a recent letter Major Callender states that differential staining has indicated that there may be no Spindle-B type of tumor. Metastasis occurred earlier in Grade III. Fifty percent of the metastases in Grade III occurred within two years whereas forty-three percent of the metastases of Grade II occurred in this same period of time. In spite of these results it is possibly not correct to consider the Mixed-cell type as a separate grade. However, the fact that the Mixed-cell type has a marked variation in size, shape, and morphology of the cell may indicate greater malignancy. Murphy[16] is of the opinion that the presence of a group of malignant cells does not cause neighboring normal cells to take on malignant characteristics, the growth of the tumor being due to an actual proliferation of tumor cells. If this is true, mixed-cell tumor indicates origin from more than one type of cell or attempt of very immature cells to differentiate into two or more somewhat less immature cell types. Whether the tumor results from a proliferation of a single cell which changes its morphological character or whether the tumor originates from a malignant transformation of more than one normal cell or embryonic rest is apparently not known. It is certainly well known that a tumor can change its cellular characteristics. This has been observed many times following operative trauma to the tumor[17]. The incorrectness of considering the Mixed-cell type as a separate grade can be determined only by a study of a large number of cases with a classification of the various combinations occurring in the Mixed-cell type as indicated in table 4.

Table 4

A CLASSIFICATION TO DETERMINE THE CORRECTNESS OF PLACING THE MIXED-CELL TYPE IN A SEPARATE GRADE

Type	No. of Cases	Metastases
Spindle A—Spindle B		
Spindle A—Fascicular	1	0
Spindle A—Epithelioid	1	0
Spindle A—Spindle B—Fascicular		
Spindle A—Spindle B—Epithelioid		
Spindle A—Fascicular—Epithelioid	1	0
Spindle A—Spindle B—Fascicular—Epithelioid		
Spindle B—Fascicular	6	3
Spindle B—Epithelioid	18	12
Spindle B—Fascicular—Epithelioid	3	1
Fascicular—Epithelioid	3	0

Orbital recurrence. Recurrence in the orbit was rarely noted. In many cases the sclera had been deeply invaded and in a number of these there was definite evidence that the tumor cells were left in the orbit at the time of enucleation. Ginsberg[15] points out that recurrences in the orbit tend to grow very rapidly. Even if these recurrences in the orbit grow slowly, were they frequent one would expect to find more cases with local recurrences. The orbit may be an infertile field for the tumors, although this does not seem plausible since it is well established that malignant melanotic tumors can originate in the orbit[18]. The contraction of Tenon's capsule around the growth may be sufficiently dense and avascular to prevent the tumor from growing. It is also possible that Tenon's capsule may hold the tumor in check long enough at least for metastases already existent or metastasis from this orbital recurrence to kill the patient before local recurrence obviously manifests itself. Small recurrences in the orbit could be overlooked. Such recurrences might go unrecognized until the growth of the tumor made it impossible for the patient to wear his prothesis. For this reason it is advisable to follow cases more carefully after enucleation, with more than a casual inspection of the socket.

Metastases. The liver is definitely the most fertile field for metastases. Is this because of the character of the blood channels, or sluggishness of the blood current in the liver; or due to bio-chemical affinity, or to the possible absence of the inhibitor material of Murphy[16]?

Table 5

DISTRIBUTION OF METASTASES

Location not specified	4	Cervical Glands	1
Liver	15	Lungs	1
General	3	Kidney	1
Spine	2	Hip	1
Stomach	1	Brain	1
		Orbit	1

The metastasis to the cervical glands is the only indication in this series of lymph-born metastases. "Metastasis" to the brain may be an extension along or through the optic nerve. All other metastases were blood-born.

Location. For simplicity and uniformity in the statistical study, the location of the smaller tumors has been indicated arbitrarily by a letter. Location A is reserved for iris tumors, none of which are reported in this series; location B indicates a tumor of the ciliary body; location C a tumor between the ciliary body and equator; and location D the fundus from the equator to near the disc. There is no accurate method to obtain the volume of the tumor. In many cases only two dimensions were accurately known. The shape of the pedunculated tumor also precludes easily obtained accurate measurements of volume. It has been suggested* that a sufficiently accurate figure might be obtained by cubing the average of the two known dimensions. This suggestion was followed.

Fuchs[12] has expressed the opinion that the tumors in the fundus are probably diagnosed earlier than those anterior to the equator because the former could be seen with an ophthalmoscope. This study bears out his opinion in that one case in three, or thirty-three percent of the tumors anterior to the equator, less than one thousand cubic millimeters in size, were diagnosed correctly whereas twelve cases in twenty-four, or fifty percent of the tumors of the same size posterior to the equator, were diagnosed correctly.

Shape. There is no correlation between shape of tumor and malignancy. There were 41 pedunculated tumors, 37 fusiform, ten flat, and three nodular tumors. Pedunculation is the obvious result after the tumor has broken through the lamina vitrea. Blood spaces were larger in the tumor head due to passive congestion. This increased blood supply, provided the circulation is not too stagnant, may produce more rapid growth, since overgrowth is noted in the legs with passive congestion resultant from arteriovenous aneurysm[19]. On the other hand, this passive congestion of the tumor head, provided the

* Donald H. Davenport—Harvard Business School. Personal communication.

circulation is sufficiently poor, must be a retarding factor to growth and must produce necrosis. The exact mechanism by which the lamina vitrea is penetrated is not obvious. Is it the result of pressure, stretching, or lysis? If it were due to lysis one would expect to find a wider neck in many cases. If it were due to a tear one would expect to find a narrow oval-shaped neck.

Some of the tumors persisted as flat growths and became very diffuse. Doherty[20] has pointed out that melanosis oculi behaved as a malignant growth in twenty-five percent of the cases he had studied. Is it not reasonable then to consider melanosis oculi as a diffuse malignant melanoma of low-grade malignancy? Certainly these flat growths appear to be a connecting link between melanosis oculi and malignant melanoma.

Multiple origin. The nodular forms of malignant melanomata suggest the possibility of multiple origins or intraocular metastases. Several cases have been reported in which there was more than one separate and distinct nodule in the eye with normal healthy tissue intervening. Since malignant melanoma cells have been found free in aqueous and since multiple discrete nodules are encountered rarely it is reasonable to consider intraocular metastasis more probable than multiple origin. If multiple origins do occur one should find cases of bilateral malignant melanomata with some degree of frequency, a finding common in retinoblastoma, in which condition multiple origins do occur[21].

Extension. The tumor can extend beyond the eye in several ways; namely, directly through sclera, along an emissarium, into the filtration angle, into Schlemm's canal and through the limbus, through perforated cornea, through operative wounds, and through the optic nerve. Extension into the optic nerve was present in twelve cases. In two cases to be reported in a subsequent paper the tumor invaded the cranial cavity along the optic nerve, destroyed the chiasmal fibers, and produced a temporal hemianopia of the other eye.

Blood spaces. By blood spaces we refer to the sinusoidlike spaces filled with blood, the walls of which are at least partially lined by tumor cells. It has been impossible, in working with this old material, to determine whether or not an endothelial wall intervened between the tumor cells and the blood spaces in every case. In some cases it was obvious that an endothelial wall was lacking in places, since tumor cells were projecting well into the lumen of these spaces, and in some instances tumor cells were free in the spaces. The size and number of the spaces, the status of the circulation, and the presence or absence of tumor cells in the spaces seemed to have no influence on the malignancy of the tumors.

It is very obvious in many cases, from the condition of the blood in the spaces, that the circulation in them was very sluggish or even entirely lacking. Therefore, the presence of tumor cells free in a blood space does not necessarily mean that millions of malignant cells are becoming emboli.

Pigmentation. There were four possible sources of pigment in these tumors: (1) the true melanotic pigment produced or laid down in and between the tumor cells, (2) normal chromatophore pigment of the uveal tract engulfed by the growth of the tumor, (3) pigment epithelium of the retina that either had been engulfed in the tumor or had grown into the tumor, and (4) blood pigment from hemorrhages or stagnant blood spaces that had been invaded or engulfed by the tumor. In some cases the differentiation of the various types of pigment was difficult or impossible without special staining methods. It was found that blood pigment was almost entirely dependent on previous hemorrhages. Pigment epithelium of the retina was very frequently stimulated to grow by the products of the tumor or by mechanical trauma.

The problems involved in the production of melanin by the tumor itself are great and are far from being solved. Likewise the production of melanin in normal melanin-bearing tissue is far from being solved, as was shown in the excellent articles by Jacobson and Klinck[22] on the subject. Bloch's[23]

"dopa" reaction gives much information but it also brings out many unanswered questions.

In many of the less-pigmented tumors the pigment was found more dense at the base of the tumors, and in or near the necrotic areas, as has been previously reported and discussed by Fuchs[12]. The age and nutrition of the parts may be more important factors favoring melanin production than cell type of the tumor. The "dopa" reaction is very sensitive to hydrogen-ion concentration. Prizibriam[24] found that juices expressed from white areas of skin are more acid than juices from pigmented skin and the weaker "dopa" reaction in blond skin may be due to a relatively different p_H. The formation of melanin in the tumors may depend on the p_H, which would certainly vary with changes in circulation and with necrobiosis or necrosis.

There was apparently no relation between the amount of pigment in the eye, i.e., blond or brunette, and the amount of pigment in the tumor.

Table 6

RELATION OF PIGMENT IN THE TUMOR TO PIGMENT IN THE EYE

		Sparsely Pigmented Tumors	Heavily Pigmented Tumors
Blond eyes	43	23	10
Brunette eyes	48	24	24
Spindle A		9	5
Spindle B		7	17
Fascicular		5	4
Epithelioid		7	5
Mixed		19	13

Necrosis, inflammation, and uveitis. Necrosis was present in sixty-seven of the ninety-four tumors. The amount varied from small areas of a few cells to almost complete necrosis of the tumor. The type varied. Degeneration and necrosis have been rather completely discussed by Ginsberg[15]. The marked extent of the necrosis in many of the tumors suggests that spontaneous cures due to complete necrosis must occur occasionally; however, in some cases necrosis was almost complete in the eye yet orbital extensions when present appeared almost free from necrosis.

Inflammation, characterized by chronic inflammatory cells distributed diffusely or in groups, was present in fifty-seven of the tumors. Inflammatory reaction was present in a very large percentage of the cases showing necrosis, yet necrosis was present without inflammation in a somewhat greater number. In the grading of other types of malignant tumors there is a difference of opinion among various observers as to whether inflammation is indicative of more or less tissue resistance.

Often, associated with the inflammation of necrosis there was a uveitis. Uveitis was present in seventy-five cases. In many instances it was manifested by a posterior synechia but in some instances the uveitis was extremely severe; in fact, one case was diagnosed as panophthalmitis. Samuels[25] has made a careful study of uveitis in this connection and is of the opinion that it is secondary to the toxins arising from necrosed tumor tissue. An inflammatory reaction can be brought about by a separated retina alone, probably by the formation of chemical irritants in the stagnant subretinal fluid. It is thought that the uveitis may therefore result from other changes in the eye in addition to necrosis of the tumor.

Sympathetic uveitis was coexistent with malignant melanoma in one case. In this case the tumor had extended through the sclera and a large episcleral nodule was present. This extension of the tumor through the sclera may be an important etiological factor for sympathetic uveitis. If sympathetic uveitis does occur in association with malignant melanoma without perforation of the globe by operation, accident, or by the tumor itself, this would seem to be an argument supporting the Anaphylactic Theory. Yet an infectious agent could reach the uveal tract and the tumor through the blood stream. In fact, Wolfrum[26] has suggested that the sympathetic uveitis of malignant melanomata may simply be a bilateral uveitis following an infection of the

poorly resisting, abnormal, tumor uveal tissue.

Separation of retina. The retina was separated in eighty-five out of ninety-one cases. In the six cases without separation there were two pedunculated tumors, two flat tumors, and two fusiform tumors, their sizes being 2744, 1331; 166, 1728; and 729, 1331 cubic millimeters, respectively. Ginsberg[15] has pointed out that the separation may be produced by fluid transuding from the choroid near the tumor as well as by a transudate from the tumor itself. Most noteworthy was the fact that in only a very few cases was the tumor not in contact with some part of the separated retina. The tumor stimulates the pigment epithelium of the retina to proliferate. This same causative factor may produce a low-grade retinitis resulting in an adhesion between the tumor head and the retina. Holes in the retina do occur in retinas separated subsequent to choroidal tumor formation. These holes are near to the ora serrata. Wintersteiner[27] thought that these holes were the direct result of too great a stretching of the retina produced by the growth of pedunculated tumor into the vitreous cavity when the retina is adherent to the head of the tumor.

Table 7

AMOUNT OF RETINAL SEPARATION

No. of Cases	7	20	33	25
Amount of Separation	+	++	+++	++++

Glaucoma. There is much conflicting evidence concerning the etiology of the glaucoma that occurs so frequently in eyes containing malignant melanomata. It is impossible to discuss this problem even briefly as a part of this paper. Therefore, the remarks concerning glaucoma are to bring out some of the points at issue and raise many questions.

Glaucoma was present in thirty-three percent of all cases. Pathological changes in the filtration angle sufficient to have produced glaucoma were present in sixteen cases in which there was no cupping of the disc and in which glaucoma had not been observed clinically. In this series, glaucoma was present in thirty percent of the cases with smaller tumors. In some of these cases the tumor was small and did not project into the vitreous cavity appreciably. With the largest tumors, when the eye was almost completely filled, glaucoma was almost uniformly present. Since glaucoma was not present in every case in which the tumor had invaded the vitreous cavity appreciably, compression of the vitreous is evidently not the explanation of the glaucoma. But, on the other hand, the toxins from the tumor, whether due to necrosis, as suggested by Samuels[25], to improper metabolism of the abnormal cells, to faulty circulation that prevents proper metabolism, or to chemical changes in the stagnant fluid below the separated retina, could have an effect on the ciliary body so as to reduce the formation of aqueous. Some such process must operate in cases of iritis, because glaucoma is not commonly associated with iritis. Such a toxic effect on the production of aqueous must account for the hypotony that sometimes occurs.

Table 8

GLAUCOMA AND LOCATION

Location	No. of Cases	No. of Cases with Glaucoma	Percent	No. of Cases with Damage to Filtration Angle with or without Glaucoma	Percent
B	14	4	28	6	43
C	25	10	40	2	48
D	47	24	51	13	78
X	5	3	60	2	100

Fuchs[12] has reported five such cases.

Duke-Elder[28] has shown that a histaminelike substance may be a causative factor in glaucoma. The tumor may directly or indirectly produce just such a substance.

Sondermann[29] believes that glaucoma is produced by a venous congestion due to a sclerosis of the veins draining the anterior uveal tract. However, in this series of cases, glaucoma was less frequent when the tumor was located in the region of the vortex veins than when the tumor was anterior and posterior to this region.

Adler[30] has shown that the retina metabolizes glucose from the vitreous. The effect of the toxins on the retina may be to stop this metabolism, which, in turn, would cause a relative increase in the glucose contents of the eye and possibly be an additional causative factor in the production of glaucoma. This may certainly be a factor in hemorrhagic retinitis—but it also should favor the production of glaucoma after embolism of the central retinal artery, an association not commonly observed.

The occurrence of a vascularized membrane on the anterior surface of the iris is a relatively rare condition. When not obviously the result of frank inflammation or hemorrhage in the anterior chamber, it is found, according to Verhoeff*, only in hemorrhagic retinitis, separated retina, and malignant melanoma. The cause of the membrane formation is not understood. However, Friedenwald* suggests that it may be the result of a necrosis of the iris or part of the iris. Samuels[31] feels that the membrane as produced in hemorrhagic retinitis is due to toxins. Vascularized membrane on the iris was seen in fourteen cases. Glaucoma was present in thirteen of these cases and an anterior peripheral synechia was present in the remaining case.

Bone formation. In only one case of this series was there bone formation, though Ginsberg[15] has found bone formation more frequently.

Duration. There are no data relative to the length of time it took the tumors in this series to reach the size present at the time of enucleation. There have been some other cases observed clinically in the last few years in which the patients refused to permit an enucleation immediately after the diagnosis was made, and in which a separation of the retina had been observed some months before the eye was removed, or in which the patient was sure that his vision had been markedly below normal for a long period of time. By such observations it is apparent that in certain instances the tumors have grown relatively slowly and that such a rate of growth suggests that months or even years may elapse before the eye would be completely filled with the tumor. The speed of growth is probably irregular. It is impossible on this meager observation to state that all malignant melanomata grow slowly.

Conclusions

1. Malignant melanoma is a better name than sarcoma for primary malignant uveal tumors.

2. The presence of a tumor was not even suspected clinically in 44.6 percent of the cases.

3. Malignant melanomata can be graded according to cellular morphology, although the value of this grading can be determined only by studies of more cases.

4. The usual "five-year-cure" period is not long enough to be presumptive evidence of a cure in cases of malignant melanomata.

5. Cells of malignant melanomata are frequently left in the orbit after enucleation, although orbital recurrence is seldom observed.

6. Metastases that become evident many years after enucleation may result from a more recent metastasis of orbital recurrence that is not recognized.

7. Malignant melanomata have invaded the optic nerve and have even invaded the cranial cavity.

8. The formation of pigment in malignant melanomata is probably related in some instances to degenerative processes in the tumor, is unrelated to the

* Personal Communications: (a) F. H. Verhoeff, (b) Jonas Friedenwald.

normal pigmentation of the eye, and is probably of no prognostic value.

9. The growth of the tumor into the vitreous cavity is probably not always the cause of the glaucoma that occurs so frequently in tumor cases.

10. Separation of the retina is the most common complication of malignant melanoma.

11. Uveitis is a common complication of malignant melanoma.

We wish to express our appreciation for helpful suggestions and criticisms from Dr. F. H. Verhoeff, Dr. S. B. Wolbach, Dr. Tracy B. Mallory, and the late Dr. George Derby.

References

[1] Duke-Elder. Recent advances in ophthalmology. Ed. 3, Philadelphia, P. Blakiston's Son and Co., 1934, p. 170.
[2] Friedenwald. Cytology and cellular pathology of the nervous system. W. Penfield, editor. New York, Paul B. Hoeber Inc., 1932, v. 3, p. 1071.
[3] Simmons. Means of determining the end results of operations on hospital patients. Boston Med. and Surg. Jour., 1912, v. 172, No. 2, p. 54.
[4] Hansemann. Studien über die Spezificität, den Altruismus und die Anaplasie der Zellen, mit besonderer Berücksichtigung der Geschwülste. A monograph published by A. Hirschwaldt, Berlin, 1893.
[5] Broders. Squamous cell epithelioma of the lip. Jour. Amer. Med. Assoc., 1920, v. 74, p. 656.
[6] Gates and Warren. Grading of epidermoid carcinoma. Surg. Gynec. Obst., 1934, v. 58, p. 962.
[7] Mills, Broders, and Caylor. The effect of treatment in cases of carcinoma. Surg. Gynec. Obst., 1931, v. 52, p. 825.
[8] Hueper. Clinical significance and application of histological grading of cancers. Ann. Surg., 1932, v. 95, p. 321.
[9] Simmons, Taylor, and Wallace. Carcinoma of the breast. New England Jour. Med. and Surg., 1934, v. 210, p. 836.
[10] Greenough and Taylor. *Ibid.*, p. 831.
[11] Parsons. Pathology of the eye. London, G. P. Putnam's Sons, 1905, v. 2, pt. 2, p. 493.
[12] Fuchs, E. (a) Das Sarkom des Uvealtraktus. Wien, 1882.
(b) Ueber Pigmentierung, Melanom und Sarkom der Aderhaut. Arch. f. Ophth., 1917, v. 94, p. 43.
(c) Ueber Sarkom der Aderhaut nebst Bemerkungen über Nekrose der Uvea. Arch. f. Ophth., 1910, v. 77, p. 304.
[13] Callender. Malignant melanotic tumors of the eye. Trans. Amer. Acad. Ophth. and Otolaryng., 1931, p. 131.
[14] Trans. Amer. Acad. Ophth. and Otolaryng., 1934, p. 475.
[15] Ginsberg. Handbuch der speziellen pathologischen Anatomie und Histologie. Berlin, Julius Springer, 1928, v. 11, pt. 1, p. 515.
[16] Murphy, J. B. Experimental approach to pre-cancer problem. Bull. Johns Hopkins Hosp., 1935, v. 56, p. 1.
[17] Terry. Sarcoma of the eyelid. Arch. of Ophth., 1934, v. 12, p. 689.
[18] Parsons. Pathology of the eye. London, G. P. Putnam's Sons, 1905, v. 2, pt. 2, p. 738.
[19] Reid. Effects of abnormal arteriovenous communication on the heart, blood vessels and other structures. Arch. of Surg., 1925, v. 11, p. 24.
[20] Doherty, W. B. (a) Cases of melanosis oculi with microscopic findings. Amer. Jour. Ophth., Series III, 1927, v. 10, p. 1.
(b) Choroidal melanomas. Trans Amer. Ophth. Soc., 1928, v. 26, p. 309.
[21] Parsons. Pathology of the eye. New York, G. P. Putnam's Sons, 1905, v. 2, pt. 2, p. 636.
[22] Jacobson and Klinck. (a) Melanin. Arch. of Path., 1934, v. 17, p. 142.
(b) *Ibid.*, p. 391.
[23] Bloch, B., and Ryhiner, P. Ztschr. f. d. ges. exper. Med., 1917, v. 5, p. 179.
[24] Matthews. Physiological chemistry. Ed. 5, Wm. Wood Co., 1930, p. 710.
[25] Samuels. Anatomical and clinical manifestations of necrosis in eighty-four cases of choroidal sarcoma. Arch. of Ophth., 1934, v. 11, p. 998.
[26] Wolfrum. Tumoren. Lubarsch-Ostertag Ergebn. d. allg. Pathol. u. pathol. Anat., Ergänzungsband, 1914, v. 16.
[27] Wintersteiner. (a) Geschwülste des Uvealtraktus, usw. Lubarsch-Ostertag Ergebn. d. Allg. Pathol. u. pathol. Anat., 1906, Jg. 10, Ergänzungsband, 2. Hälfte, p. 1044.
(b) Ueber Irissarkom und Irisendotheliom. Arch. f. Ophth., 1908, v. 69, p. 75.
[28] Duke-Elder, Sir Stuart and Lady. Etiology of glaucoma. Arch. of Ophth., 1935, v. 11, p. 49.

[29] Sondermann. Meine Glaukomtheorie und die Klinik des Glaukoms. Klin. Monatsbl. f. Augenh., 1934, v. 93, p. 313.

[30] Adler, F. H. (a) An investigation of sugar contents of pre-ocular fluids under normal and abnormal conditions and glycolytic activity of the tissues of the eye. Trans. Amer. Ophth. Soc., 1930, v. 28, p. 307.
(b) Metabolism of the retina. Arch. of Ophth., 1931, v. 6, p. 901.

[31] Samuels. Pathological change in the anterior half of the globe in obstruction of the central retinal vein of the retina. Trans. Amer. Ophth. Soc., 1934, p. 369.

Discussion. DR. W. H. WILDER: Do your statistics show anything that would give us an idea as to whether the early removal of the eye before the stage of irritation improved the outcome?

DR. TERRY: I cannot give you any statistics relating to the size of the tumor and the end results, but we do know that some of the very small tumors have produced metastasis and death.

DR. JONAS S. FRIEDENWALD: What is the relation between invasion of the sclera and frequency of metastasis?

DR. TERRY: Although the statistics relative to this question were given by me in discussion of the paper on uveal sarcoma by Drs. Byers and MacMillan at the recent American Ophthalmological Society meeting, I do not have them with me now. They indicated that metastases were more common when the sclera and optic nerve were invaded, but in one remarkable instance, cells of a fascicular type of tumor were left in the orbit, as shown by study of the specimen, seventeen years ago, yet this patient is living and well today.

DR. A. L. MACLEAN: Might flashes of light in the portion of the visual field corresponding to the location of a benign fundus melanoma be considered an indication that malignant changes are taking place?

DR. TERRY: I cannot answer that question from clinical experience. Dr. William P. Beetham of Boston has had one or two cases in which he thought that the perimeter had been of value in differentiation. He found normal visual fields in cases of benign melanoma whereas his cases of malignant melanomata showed scotomata corresponding to the area of the tumor. This observation is from too few cases to go on record as a definite diagnostic criterion.

DR. FRANK E. BURCH: Were any conclusions arrived at as to the influence of perradiation or radiation after removal, upon the incidence of recurrence or metastases?

DR. TERRY: None, whatsoever. We have no information on it at all. No radiation was done on these tumors. The X-ray and radium men in our clinic think that these tumors are X ray and radium fast.

In personal communication, Dr. Laura Lane stated that she thought it might be worth while to give a person a large dose of X ray or radium before the operation, not to kill the tumor cells, but to form a very heavy fibrosis to encase any cells left behind after operation.

DR. WILLIAM H. LUEDDE: Is trauma or previous inflammation a factor in etiology?

DR. TERRY: My personal feeling is that trauma or inflammation is not an etiological fact, but that is an opinion. Many people sustain some sort of trauma to their eyes during life yet few of them develop tumors. In most instances you can get a history of trauma from any patient who has a tumor. History of trauma is very unreliable; for example, we sometimes find X-ray evidence of intraocular foreign bodies in patients who cannot recall having had an accident.

MEASUREMENT (ROENTGENOMETRY) OF ANTERO-POSTERIOR DIAMETER OF THE EYEBALL IN SITU CORRELATED WITH MICROMETER MEASUREMENT FOLLOWING ENUCLEATION

DEWEY KATZ, M.D.

AND

ALFRED C. LEDOUX, M.D.

CHICAGO

Radiopaque substances were injected retrobulbarly and applied to the apex of the cornea of animals. Roentgenograms were taken and the shadows of the radiopaque substances were readily perceptible and well defined; they delineated the posterior half of the eyeball and the apex of the cornea. The antero-posterior diameter of the eyeballs in the roentgenograms was measured with a vernier caliper. The eyeballs were enucleated and after a droplet of radiopaque substance had been applied to the apex of the cornea and to the sclera at the posterior pole, roentgen films were taken of the enucleated bulbs. The antero-posterior diameter of the roentgen shadows of the enucleated bulbs was measured with a vernier caliper. The enucleated bulbs were measured with a metric micrometer caliper. The roentgen measurements, corrected by triangulation, of fifty cats' eyes *in situ* and following enucleation are compared with the micrometer caliper measurements of the corresponding enucleated eyeballs. The instruments devised for this work are described and six tables summarize the results of the investigation. From the Divisions of Ophthalmology and Roentgenology, The University of Chicago. Read before the American Association for Research in Ophthalmology, at Atlantic City, June 11, 1935.

The solution of a number of important and fundamental ophthalmological problems awaits the evolvement of a method, simple in its application, which will enable one accurately to measure the antero-posterior diameter of the eyeball *in situ*. The importance of such a procedure has long been recognized. To date, no method has been described which can be given serious consideration.

One of the important advances in medicine in the past few years has been the increasing and successful use of various radiopaque media in outlining some of the organs within the body. The use of such a substance to delineate the external surface of the sclera at the posterior pole suggested itself to one of the authors (D. K.) when, in a case of penetrating wound of the eyeball, the question arose as to whether a foreign body was just within, in, or just without the sclera at the posterior pole. By gradual alterations of the original technique used in this instance, a procedure has been evolved which enables us to measure the antero-posterior diameter of the cat's eye *in situ*.

The essential steps in our experimental study were: (1) the delineation of the anterior and posterior poles of the eye by means of radiopaque media which cast readily visible and clear-cut roentgenographic shadows, (2) the accurate measurement of the distance between the two roentgenographic shadows, (3) the correction of the measurement, because of roentgenographic distortion, by a mathematical process known as simple triangulation, and (4) the comparison, in a series of fifty eyes, of the corrected roentgenographic measurement of the antero-posterior diameter of the eyeball *in situ* with the micrometer caliper measurement of this diameter of the corresponding enucleated eyeball.

Rabbits were used in our early experiments, and of the various radiopaque media injected retrobulbarly, along the nasal and temporal horizontal meridians, diodrast was selected as the medium of choice. Roentgenographs of the head were made and it was noted that the anterior edge of this radiopaque medium had a curvature which simulated that of the external surface of the posterior one half of the sclera. Various opaque media were suggested for use to delineate in the roentgenogram the anterior surface of the cornea. Ariodol

was found to be most satisfactory for this purpose. A very small amount of this medium, in droplet form, could be placed on the anterior surface of the apex of the cornea. The roentgenographic shadow of this marker was readily visible, clear cut, and distinctive.

Frequently in the roentgenogram, the anterior edge of the shadow of the diodrast was superimposed upon the shadow of the mandible and because of the greater density of the latter it was impossible in some of these cases to be reasonably certain as to the exact location of the former. Puppies were then used but the same difficulty was encountered. This objection was eliminated by the use of cats. In this animal, the topography of this region is such that in the roentgenogram half of the concave anterior edge of the shadow of the retrobulbarly injected diodrast is external to the shadow of the mandible. Where the shadows do overlap each other they cross at acute angles and are readily distinguished from one another.

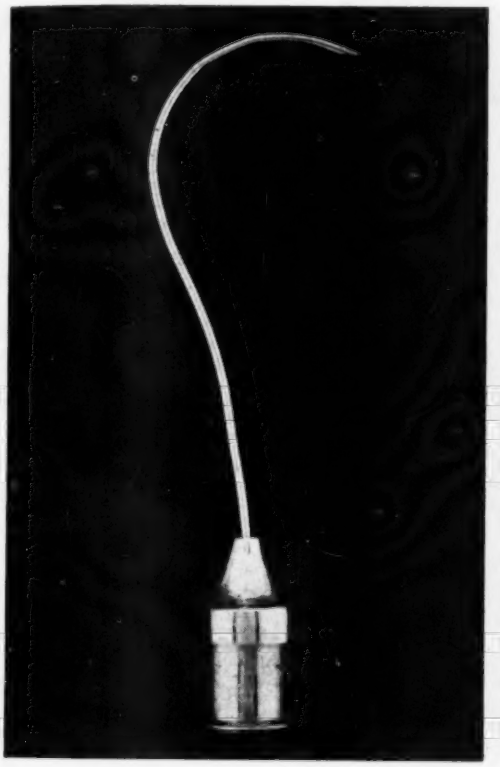


Fig. 1 (Katz and Ledoux). Curved needle used for the retrobulbar injection of diodrast. (Devised by Mr. Mueller.)

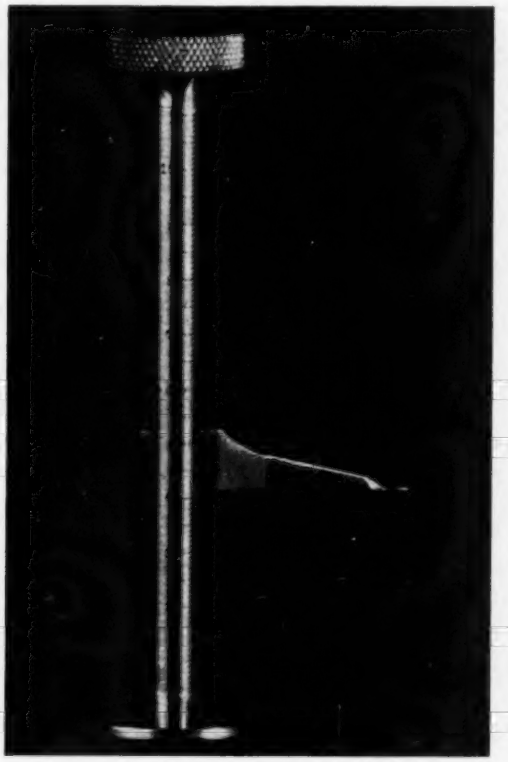


Fig. 3 (Katz and Ledoux). The vertical-height caliper.

Technique of the procedure

The cat was etherized in a glass jar with a well-fitting glass top. When etherized the animal was removed from the jar, tied to an animal board and ether anesthesia was continued by the drop method. Diodrast was injected retrobulbarly. In our early experiments the curved needle employed for this purpose was similar to the type used for the retrobulbar injection of procaine-adrenaline solution in cases of cataract extraction. A needle (fig. 1) was devised, however, which has more nearly the curvature of the eyeball. When this needle was passed backward it was rotated so that its point was kept in con-

tact with the surface of the sclera. The diodrast was injected when the needle point was in the neighborhood of the optic nerve. In the series now reported, this type of needle was used exclusively.

Injection routes were along the nasal and temporal horizontal meridians. When we learned that a single injection gave equally good results, the nasal route was the one used. The passage of the needle backwards along this route is easier because in the cat the distance between the eyeball and the nasal wall of the orbit is much greater than that

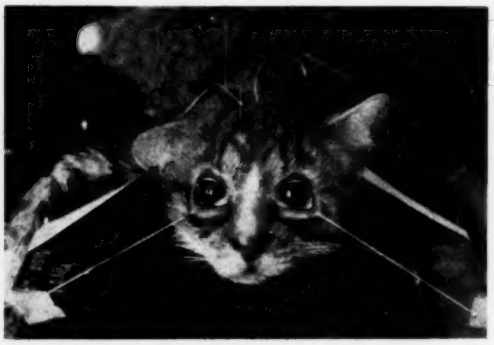


Fig. 2 (Katz and Ledoux). This shows the relationship of the cat's head to the cassette and the arrangement of the sutures for the almost complete exposure of the corneas.

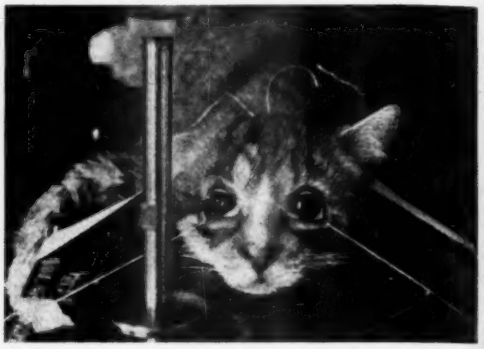


Fig. 4 (Katz and Ledoux). Illustrates the relationship of the vertical-height caliper to the cornea when ariodol is applied to the apex.

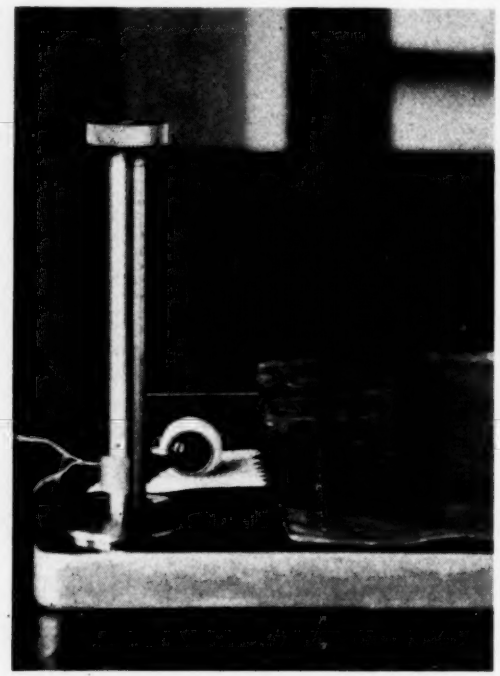


Fig. 6 (Katz and Ledoux). The ariodol is applied to the apex of the cornea of the enucleated bulb by means of the vertical-height caliper. The bulb is placed on a piece of rough paper so that it is kept immobile. Half of the cassette is covered by a lead plate.

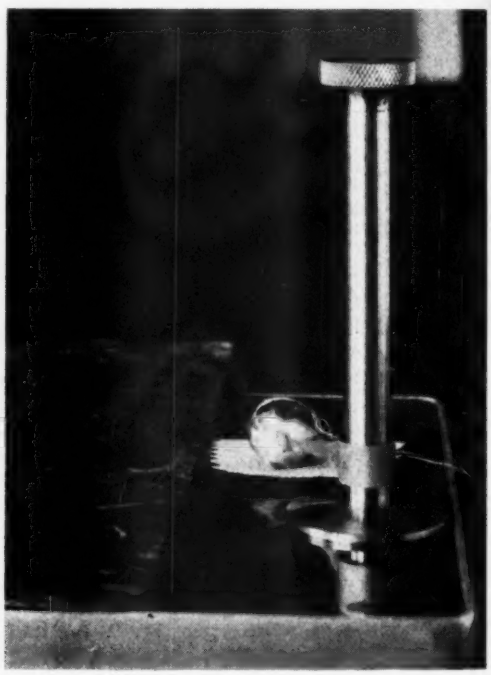


Fig. 7 (Katz and Ledoux). A droplet of ariodol is applied to the posterior pole.

between the eyeball and the temporal orbital margin. In our series bilateral injections were carried out in twenty instances and the single injection along the nasal route was used in thirty cases.

Fig. 5 (Katz and Ledoux). Roentgenogram of cat's head. The ariodol marker delineates the apex of the cornea and the diodrast shadow delineates the external surface of the posterior half of the sclera.

The total amount of diodrast injected retrobulbarly varied from 0.4 c.c. to 1.0 c.c. When injected along the temporal and nasal routes the total was divided equally in most instances. The best results were secured when 0.6 to 0.8 c.c. of diodrast was injected, the former in young cats with small eyes and the latter in older cats with larger eyes. In our series 0.4 c.c. was injected once; 0.5 c.c. five times; 0.6 c.c. twenty-seven times; 0.7 c.c. four times; 0.8 c.c. ten times; and 1 c.c. three times.

In our early cases we passed a silk suture through each lid margin and each nictitating membrane. The cassette with its contained roentgen film was placed on the animal board beneath the cat's head and neck (fig. 2). The head was fixed to the cassette by means of a strip of adhesive tape which was passed over the neck and made adherent to the sides of the animal board. The upper-lid sutures were fixed to this piece of adhesive tape, the lower-lid sutures to the board or sides of the cassette, and the sutures through the nictitating membranes were tied together over the bridge of the nose. This resulted in almost complete exposure of both corneas.

Fig. 8 (Katz and Ledoux). Roentgenograms of enucleated eyeballs. The apex of the cornea and the posterior pole are delineated by ariodol.

It now became necessary to apply a droplet of ariodol to the apex of each cornea. It was also essential that the distance between this corneal marker and the surface of the cassette be measured. A special vertical-height caliper (fig. 3) was devised. The use of this instrument enabled us to effect both steps readily and accurately. It consists of a base, a millimeter calibrated barrel, a sleeve with a vernier scale, a hollow arm 0.5 mm. in diameter at its end, and a knurled adjusting nut on the upper end of the barrel. The end of the arm was first dipped in ariodol, a small amount of which remained adherent to it. The instrument was placed on the cassette and the knurled adjusting nut rotated so that the arm was level with the apex of the right cornea. The height caliper was moved toward the eye until the end of the arm touched the apex of the cornea (fig. 4). The instrument was withdrawn and a small droplet of ariodol remained on the cornea at the desired level. The reading, taken directly from the calibrated barrel and the vernier scale, was recorded. This was repeated for the left eye. A roentgenograph of the head was made (fig. 5).

From the results secured in our early experiments we learned that the con-

cave anterior border of the diodrast shadow was most clear cut approximately twelve minutes after its injection. Whenever possible the roentgenograph of the head was made when this time limit had elapsed. After the roentgenograph had been made, a lethal dose of ether was administered.

A suture was taken in the conjunctiva adjacent to the temporal limbus in the horizontal meridian of each eye. The right eyeball was enucleated. The suture oriented the temporal meridian of the enucleated eyeball at all times. The eyeball was placed on the cassette so that its horizontal meridian was parallel, or practically so, to the surface of the cassette. The end of the arm of the vertical-height caliper was dipped into the ariodol. The instrument was placed on the cassette and adjusted so that the arm was level with the apex of the cornea. The caliper was then moved toward the cornea until the apex was touched by the arm (fig. 6). A small droplet of ariodol remained adherent to the cornea. The distance between the surface of the cassette and the apex of the cornea was read directly and recorded. The height caliper was moved and adjusted so that a droplet of ariodol was placed on the posterior surface of the sclera at a point about 2 mm. from the temporal side of the optic nerve and level with the long posterior ciliary artery (fig. 7). This, we felt certain, was very close to the posterior pole if not at the posterior pole of the eye. The distance between this point and the surface of the cassette was read directly and recorded. A roentgenograph of the eyeball was made. The left eyeball was enucleated and the procedure repeated (fig. 8).

In our early experiments the cat was kept anesthetized and the experiment carried out as above described. To simplify the technique without in any way altering any of the fundamental relationships, the animal was kept anesthetized for a period of twelve minutes after the retrobulbar injection and then electrocuted. The lids and nictitating membranes were excised, following which the apex of the cornea was touched with ariodol and the experiment continued as described.

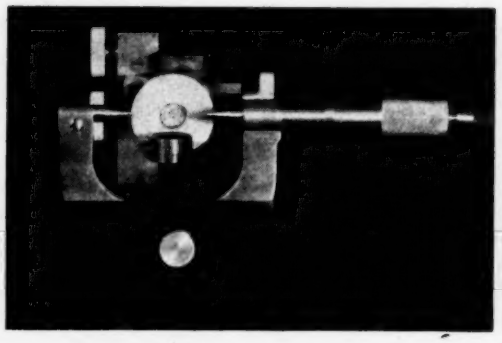


Fig. 9 (Katz and Ledoux). The modified micrometer caliper inserted into place in the groove in the special eye stage.

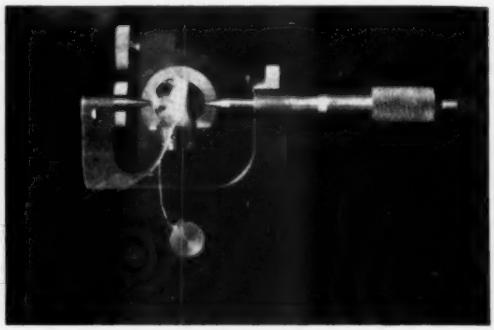


Fig. 10 (Katz and Ledoux). The eye stage has been adjusted so that the antero-posterior diameter of the enucleated eyeball is readily measured by the micrometer caliper.

The antero-posterior diameter of each enucleated eyeball was then measured with a metric micrometer caliper. To make this procedure simple and accurate a special eye stage was devised and the caliper modified (fig. 9).

The eye stage was constructed so that a disc, with concave upper surface into which the eyeball was placed, could be moved upward and downward, forward and backward, right and left, and rotated, with regard to the eye, in either the vertical or horizontal meridians. There was a groove in the base of the stage into which the micrometer caliper was inserted and firmly held in place.

The caliper was modified by the ad-

dition of a fixed arm (anvil), and both the fixed and movable arms were ground to taper from their original diameter of 5 mm. to a diameter of 1 mm. at their free ends. By the addition of the long anvil the original micrometer range of 25 mm. to 50 mm., by hundredths of a millimeter, was altered so that its range was from 12 mm. to 37 mm. We therefore deducted 13 mm. from all our metric micrometer caliper readings, the correction made necessary by the long anvil.

The right enucleated eyeball was placed on the disc. This was then adjusted so that the external surface of the sclera at the posterior pole was in contact with the end of the fixed arm and the end of the movable arm was in line with the apex of the cornea. The micrometer thimble was rotated until the end of the movable arm was in contact with the apex of the cornea (fig. 10). The reading was taken directly from the micrometer scale on the barrel and thimble. The eyeball was measured in this manner three times. Thirteen millimeters was subtracted from the average of three readings and the resulting figure was considered to be the exact antero-posterior diameter of the eyeball. We believe that these measurements were as accurate as it is humanly possible to make them. The left enucleated eyeball was measured in the same manner.

When the roentgenograms were dry they were placed in a viewing box, and the antero-posterior diameter of the eyeballs *in situ* and of the enucleated eyeballs was measured with the inside jaws of a metric vernier slide caliper. This instrument is calibrated to 0.1 of a millimeter. The jaws were filed to sharp points to increase the accuracy of our readings. Since the completion of this series of experiments, we have modified a metric (inside) micrometer caliper which will give more accurate readings, as it is graduated to 0.01 of a millimeter (fig. 11). For the eyeball *in situ* the distance betwen a point on the corneal edge of the ariodol marker and the point on the scleral edge of the diodrast shadow, as the latter crosses the image of the mandible, was measured. In the roentgenogram the posterior pole of the eyeball was localized at this junction because in a longitudinal section through the fovea of a frozen cat's head, made by a band-saw, the external surface of the sclera at the fovea and the external surface of the mandible in this section were almost in the same vertical plane. The antero-posterior diameter of the eyeball *in situ* was measured three times. The average of these three readings was then corrected by triangulation. The roentgenographic shadows of the radiopaque media and the points to be measured are better defined and more readily differentiated when viewed through a hand magnifying lens. The distance between the two ariodol shadows on the roentgenograms of the enucleated eyeballs was measured three times and the average of the three readings was corrected by triangulation. The corrected roentgenographic measurements of the antero-posterior diameter of the eyeball *in situ* and of the enucleated eyeball were compared with the micrometer caliper measurement of the corresponding enucleated eyeball and with each other.

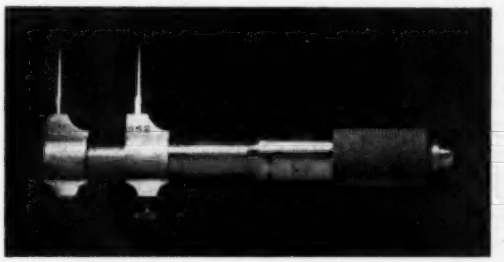


Fig. 11 (Katz and Ledoux). The metric micrometer caliper modified so that the distance, on a roentgenogram, between two delineated points can be accurately measured.

Roentgenographic technique

As roentgen rays diverge from their point of emanation, the roentgenographic shadow of an object is always greater than the object casting the shadow. Several methods have been described which enable one to correct for the roentgenographic distortion if certain requirements are fulfilled.

The subject of roentgen mensuration is by no means a new one. Budin and Varnier (1897) devised a method of computing the obstetrical diameters of the human pelvis by calculations based on measurements of roentgen-ray shadows. Hodges and Ledoux (1932) have reclassified all published methods into two major groups. These are the position methods and the parallax methods.

The particular method of roentgen mensuration used in this work was a position method known as simple triangulation. As in all position methods, three distinct steps are necessary for its application. These are: (1) The diameter to be measured must be clearly visualized on the roentgenogram. (2) The subject must be so placed that the plane of the diameter to be measured will be parallel to the plane of the film. (3) The target-film and the object-film distances must be accurately known.

The first requirement has been met by the use of radiopaques for delineation of the antero-posterior diameter of of the eyeball *in situ*.

The second requirement has been fulfilled by placing the animal chin down on the cassette, so that the plane of the horizontal meridian of the eyeball was parallel, or practically so, to the plane of the film. The roentgen tube was then centered by means of a plumb-bob over the mid-point of a line through the centers of both eyes.

A constant fixed target-film distance of 1640 millimeters was used. A long target-film distance was purposely chosen so that the distortion due to divergence of radiation was reduced to a minimum. The object-film distance was a variable, but was accurately measured by use of the metric height caliper. The third requirement was thus fulfilled.

This same technique was repeated in the filming of the eyeballs following enucleation. All of the roentgenographs were made at 85 kilovolts (peak) and 100 milliamperes. The time factor was variable.

With the fulfillment of these three requirements it became possible to compute the true diameter by use of the following equation:

$$D = S\left(\frac{T.F.D.—O.F.D.}{T.F.D.}\right) \text{ where}$$

D = the diameter of an object casting a roentgen shadow; S = the diameter of the roentgen shadow; T.F.D. = the distance between the roentgen-tube target and the roentgen film; and

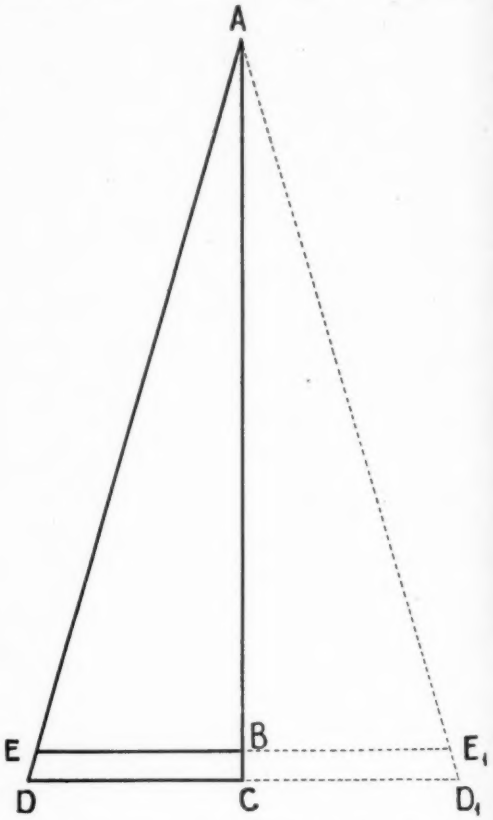


Fig. 12 (Katz and Ledoux). Graphic representation of the position method known as simple triangulation.

O.F.D. = the distance between the object and the roentgen film.

This equation is shown more graphically in figure 12, where: D = EB; S = DC; O.F.D. = BC; and T.F.D. = AC.

As a result of our present work, and as is readily seen in our tables, it can be stated that whenever the subject has been placed correctly and the target-film and object-film distances are known, and points on the roentgeno-

gram which are to be measured can be identified, the actual distance between these points can be readily computed with a high degree of accuracy.

Description of one experiment

The description of one experiment with the results secured will serve as an example of the procedure and appears in our records as follows: Feb. 27, 1935. Cat No. 59. Ether started at 3:18 p.m. Right eye: 0.8 c.c. of diodrast, retrobulbar, nasal route, horizontal meridian at 3:23 p.m. Left eye: 0.8 c.c. of diodrast, retrobulbar, nasal route, horizontal meridian at 3:24 p.m. Electrocution at 3:34 p.m. The lids were excised. The head was fixed in place on the cassette by adhesive tape. A droplet of ariodol was placed on the apex of each cornea with the arm of the vertical-height caliper. The distance from the surface of the cassette to the apex of the right cornea was 37.7 mm. The distance from the surface of the cassette to the apex of the left cornea was 39 mm. A roentgenograph of the head was made at 3:48 p.m. A suture was taken in the conjunctiva adjacent to the temporal limbus in the horizontal meridian of each eyeball. The right eye and then the left eye were enucleated. The micrometer caliper measurements of the antero-posterior diameter of the enucleated right eyeball, after subtracting 13 mm., were 21.6675 mm., 21.6650 mm., 21.5550 mm. The average was 21.6292 mm. The micrometer caliper measurements of the antero-posterior diameter of the enucleated left eyeball were: 21.60 mm., 21.5376 mm., 21.56 mm. The average was 21.5658 mm. The right enucleated eyeball was placed in the center of one half of the cassette, the other half being protected by a lead shield, and ariodol was applied to the apex of the cornea and to the sclera at the posterior pole by means of the vertical-height caliper. The distance from the surface of the cassette to the apex of the cornea was 11.1 mm. The distance from the surface of the cassette to the posterior pole was 11.15 mm. The average distance was 11.125 mm. A roentgenograph of the right enucleated eyeball was made. The left enucleated eyeball was placed on the cassette over the unexposed half of the film, the previously exposed half being protected by the shield. Ariodol was applied to the apex of the cornea and to the posterior pole of the left eyeball by means of the vertical-height caliper. The distance from the surface of the cassette to the apex of the cornea was 9.9 mm. The distance from the cassette to the posterior pole was 9.1 mm. The average distance was 9.5 mm. A roentgenograph of the left enucleated eyeball was made. The metric vernier slide caliper measurements of the antero-posterior diameter of the right eyeball *in situ* from the roentgenogram were 21.95 mm., 21.9 mm., 22 mm. The average was 21.95 mm. As the roentgen film was 1.5 mm. from the surface of the cassette the equation for triangulation was: 1640 mm.: 1600.8 mm. = 21.95 mm.: x; x = 21.4253 mm. The figure 1600.8 mm. is equal to T.F.D. — O.F.D. which in this instance was 1640 mm. — (37.7 mm. + 1.5 mm.). The measurements of the antero-posterior diameter of the left eyeball *in situ* from the roentgenogram were 21.85 mm., 22 mm., 21.9 mm. The average was 21.9167 mm. The equation for triangulation was 1640 mm.: 1599.5 mm. = 21.9167 mm.: x; x = 21.3754 mm. The measurements of the antero-posterior diameter of the enucleated right eyeball from the roentgenogram were 21.9 mm., 21.75 mm., 21.75 mm. The average was 21.8 mm. The equation for triangulation was 1640 mm.: 1627.375 mm. = 21.8 mm.: x; x = 21.6321 mm. The measurements of the antero-posterior diameter of the enucleated left eyeball from the roentgenogram were 21.55 mm., 21.6 mm., 21.55 mm. The average was 21.5667 mm. The equation from triangulation was 1640 mm.: 1629 mm. = 21.5667 mm.: x; x = 21.422 mm.

Summarizing the results of this experiment it is seen that the micrometer caliper measurement of the antero-posterior diameter of the enucleated right eyeball was 21.6292 mm., the corrected metric vernier slide caliper measurement of the roentgenogram of the right eyeball *in situ* was 21.4253 mm. and that of the roentgenogram of the enucleated

eyeball was 21.6321 mm. The micrometer caliper measurement of the anteroposterior diameter of the enucleated left eyeball was 21.5658 mm., the corrected metric vernier slide caliper measurement of the roentgenogram of the left eyeball *in situ* was 21.3754 mm., and that of the roentgenogram of the enucleated eyeball was 21.422 mm.

Results

Table 1 (page 923) shows the results of our experiments. In the column in which the difference between the micrometer caliper measurement of the enucleated eyeball and the corrected roentgenographic measurement of the eyeball *in situ* is given, the + or — sign designates how much greater or less the latter was compared with the former. The same is true in the column in which there is recorded the difference between the micrometer measurement of the enucleated eyeball and the corrected roentgenographic measurement of the enucleated eyeball, as it is quite obvious that the most accurate measurements of the eyeball are the micrometer caliper measurements of the enucleated eyeball. In the column in which the difference between the corrected roentgenographic measurement of the enucleated eyeball and the corrected roentgenographic measurement of the eyeball *in situ* is recorded, the latter is compared with the former.

The value of any procedure of this nature depends upon the ability of others to use it and to secure comparable results.

Thirty-three enucleated eyeballs and the corresponding measurable roentgenograms of the eyeballs *in situ* and of the enucleated eyeballs were measured independently by an uninterested third party* in the same manner as above described. The average of the readings was corrected by triangulation. His results are shown in the table to the right of the heavy black line.

Summary of Author's Results

The difference between the *micrometer caliper measurement* of the *enucleated eyeball* and the *corrected roentgenographic measurement* of the corresponding *eyeball in situ* varied from 0.0058 mm. to 0.6511 mm. The difference between:

0.0000—0.1000 mm.	=	8 cases
0.1001—0.2000 mm.	=	11 cases
0.2001—0.3000 mm.	=	15 cases
0.3001—0.4000 mm.	=	8 cases
0.4001—0.5000 mm.	=	6 cases
0.5001—0.6000 mm.	=	1 case
0.6001—0.6511 mm.	=	1 case

The average error was 0.2488 mm.

The difference between the *micrometer caliper measurement* of the *enucleated eyeball* and the *corrected roentgenographic measurement* of the corresponding *enucleated eyeball* varied from 0.0029 mm. to 0.5791 mm. The difference between:

0.0000—0.1000 mm.	=	13 cases
0.1001—0.2000 mm.	=	17 cases
0.2001—0.3000 mm.	=	14 cases
0.3001—0.4000 mm.	=	5 cases
0.4001—0.5000 mm.	=	2 cases
0.5001—0.5791 mm.	=	2 cases

The average error was 0.1967 mm.

The difference between the *corrected roentgenographic measurement* of the *enucleated eyeball* and the *corrected roentgenographic measurement* of the corresponding *eyeball in situ* varied from 0.0057 mm. to 0.4540 mm. The difference between:

0.0000—0.1000 mm.	=	24 cases
0.1001—0.2000 mm.	=	8 cases
0.2001—0.3000 mm.	=	10 cases
0.3001—0.4000 mm.	=	5 cases
0.4001—0.4540 mm.	=	2 cases

The average error was 0.1493 mm.

Summary of Results Independent Observer

The difference between the *micrometer caliper measurement* of the *enucleated eyeball* and the *corrected roentgenographic measurement* of the corresponding *eyeball in situ* varied from 0.0127 mm. to 0.7173 mm. The difference between:

0.0000—0.1000 mm.	=	6 cases
0.1001—0.2000 mm.	=	8 cases
0.2001—0.3000 mm.	=	6 cases
0.3001—0.4000 mm.	=	5 cases

* We are indebted to John T. Stough, M.D. for the independent observations.

Table 1

THE RESULTS SECURED BY THE AUTHORS OF THIS PAPER ARE RECORDED TO THE LEFT OF THE HEAVY BLACK LINE, THOSE OF THE THIRD PARTY ARE RECORDED TO THE RIGHT OF THIS LINE. THE TABLE INCLUDES THE MICROMETER CALIPER MEASUREMENTS OF THE ANTERO-POSTERIOR DIAMETERS OF THE ENUCLEATED EYEBALLS, THE CORRECTED ROENTGENOGRAPHIC MEASUREMENTS OF THE EYEBALLS *in situ* AND OF THE ENUCLEATED EYEBALLS. THE DIFFERENCES IN MEASUREMENTS BETWEEN THESE VARIOUS CATEGORIES ARE RECORDED.

Date	Cat No	Eye	Amount of Diodrast Injected		Measurements in Millimeters of:-			Difference in Measurements Between-			Measurements in Millimeters of:-			Difference in Measurements Between-		
			Nasal Route c.c.m.	Temporal Route c.c.m.	Enucleated Eyeball	Eyeball in Situ (Roentgenographic) (after Correction)	Enucleated Eyeball (Roentgenographic) (after Correction)	Enucleated Eyeball and Eyeball in Situ	Enucleated Eyeball (Actual) and Enucleated Eyeball (Roentgenographic)	Enucleated Eyeball (Roentgenographic) and Eyeball in Situ	Enucleated Eyeball	Eyeball in Situ (Roentgenographic) (after Correction)	Enucleated Eyeball (Roentgenographic) (after Correction)	Enucleated Eyeball and Eyeball in Situ	Enucleated Eyeball (Actual) and Enucleated Eyeball (Roentgenographic)	Enucleated Eyeball (Roentgenographic) and Eyeball in Situ
10-1-34	33	Left	0.5	0.5	18.0767	17.8442	18.0924	−.0325	+0.0157	−0.2482						
10-3-34	34	Right	0.4	0.2	20.2983	20.3041	20.3132	+0.0058	+0.0149	−0.0091						
		Left	0.4	0.4	20.1575	20.1575	20.3432	+0.4000	+0.1857	+0.2143						
10-9-34	35	Right	0.3	0.3	18.1275	17.4764	17.8616	−0.6511	−0.2659	−0.3852	18.4050	17.6877	17.7425	−0.7173	−0.6925	−0.0248
		Left	0.3	0.1	17.7308	17.8316	17.5723	+0.1008	−0.1585	+0.2593	17.8223	17.9295	17.6054	+0.1072	−0.2169	+0.3241
10-10-34	36	Right	0.25	0.25	18.2333	17.9487	17.6893	−0.2846	−0.5440	+0.2594	17.9533	18.1445	17.8899	+0.1912	−0.0634	+0.2546
		Left	0.3	0.3	18.2467	*	18.1929	———	−0.0538	———	18.2358	*	18.2992	———	+0.0564	———
11-6-34	37	Right	0.3	0.2	19.1367	18.9374	18.8911	−0.1993	−0.2456	+0.0463	19.1426	19.0355	18.8247	−0.1070	−0.3178	+0.2108
11-14-34	38	Right	0.3	0.3	19.5083	19.7110	19.4100	+0.2027	−0.0983	+0.3010						
		Left	0.3	0.3	19.8525	19.7646	19.4914	−0.0879	−0.3611	+0.2732						
11-26-34	39	Right	0.6	0.4	21.7050	21.6950	21.6376	−0.0100	−0.0674	+0.0574						
		Left	0.5	0.5	21.6825	21.6667	21.5279	−0.0158	−0.1546	+0.1388						
12-4-34	40	Right	0.3	0.3	19.5483	19.1602	19.2497	−0.3881	−0.2986	−0.0895	19.5081	19.0858	19.2000	−0.4223	−0.3081	−0.1150
		Left	0.25	0.25	19.4892	19.0571	19.1946	−0.4321	−0.2946	−0.1375	19.3841	19.2040	19.1119	−0.1770	−0.2698	+0.0921
12-13-34	41	Right	0.3	0.3	18.9158	18.9549	18.9091	+0.0209	−0.0661	+0.0452	18.8600	18.9222	18.6824	+0.0622	−0.1976	+0.2598
		Left		0.5	19.0533	18.7913	18.7636	−0.2560	−0.2897	+0.0337	19.0383	19.0256	18.5648	−0.0127	−0.4735	+0.4608
12-18-34	42	Right	0.3	0.3	18.8725	18.6293	Unexposed Film Blank Film	−0.2432	———	———						
		Left	0.25	0.25	18.9515	18.7494	18.6534	−0.2021	−0.3041	+0.0960						
1-8-35	43	Right	0.3	0.3	20.0892	19.8646	19.7935	−0.2246	−0.2957	+0.0711						
1-10-35	44	Right	0.6		19.8633	19.8206	19.8456	+0.0663	−0.0177	+0.0840	19.9350	20.0926	19.9449	+0.1576	−0.0101	+0.1677
		Left	0.3	0.3	20.0383	19.9134	19.8892	−0.1249	−0.1491	+0.0242	19.9850	19.8645	19.5518	−0.1205	−0.4332	+0.3127
1-14-35	45	Right	0.6		20.6800	20.4757	20.5219	−0.2043	−0.1581	−0.0462	20.6550	20.4106	20.3384	−0.2444	−0.1166	−0.1278
		Left	0.3	0.3	20.7650	20.4228	20.5547	−0.3422	−0.2103	−0.1319	20.6633	20.5408	20.5712	−0.1225	−0.0921	−0.0304
1-22-35	46	Right	0.6		20.4358	20.2654	20.2482	−0.1704	−0.1876	+0.0172	20.2842	20.2491	20.1489	−0.0351	−0.1353	+0.1002
		Left	0.6		20.2281	19.8931	20.0852	−0.4850	−0.1429	−0.3421	20.1742	19.8193	19.9713	−0.3549	−0.2029	−0.1520
1-24-35	47	Right	0.6		19.7983	19.5026	19.5949	−0.2957	−0.2034	−0.0923	19.8400	19.4863	19.5452	−0.3537	−0.2948	−0.0589
		Left	0.6		19.8667	19.4934	19.5876	−0.3733	−0.2791	+0.0058	19.8700	19.6606	19.4863	−0.2094	−0.3837	+0.1743
1-28-35	48	Right	0.6		21.6450	21.3586	21.3915	−0.2864	−0.2475	−0.0389	21.4242	21.3586	21.3478	−0.0656	−0.0763	+0.0107
		Left	0.6		21.6350	21.7819	21.3219	+0.1469	−0.3011	+0.4540	21.4975	21.7654	21.2285	+0.2681	−0.2690	+0.5371
2-4-35	49	Right	0.6		20.1100	19.9822	20.1553	−0.1278	+0.0453	−0.1731						
		Left	0.6		20.0475	19.7704	19.9749	−0.2771	−0.0726	−0.2045						
2-8-35	51	Right	0.6		18.6258	18.8078	18.8016	+0.1820	+0.1758	+0.0062						
		Left	0.8		18.8369	*	18.7207	———	−0.1162	———						
2-7-35	52	Right	0.6		19.2875	18.9252	19.3290	−0.3623	+0.0415	−0.4038						
		Left	0.6		19.2150	19.3393	19.1089	+0.1243	−0.1061	+0.2304						
2-11-35	53	Right	0.6		20.2125	20.0425	20.0511	−0.2300	−0.2214	−0.0086						
		Left	0.6		20.0316	19.8323	19.8286	−0.2035	−0.2092	+0.0057						
2-14-35	54	Right	0.6		17.9967	*	17.8964	———	−0.1003	———	17.9125	*	17.9294	———	+0.0169	———
		Left	0.6		18.0906	18.0140	17.6903	−0.0766	−0.4003	+0.3237	18.1908	17.9814	17.8560	−0.2094	−0.3348	+0.1254
2-19-35	55	Right	0.6		21.2108	*	21.0899	———	−0.1809	———	21.2225	*	21.1068	———	−0.1160	———
		Left	0.6		21.1662	20.9952	21.1860	−0.1710	+0.0207	−0.1917	20.9908	21.0441	21.0049	+0.0533	+0.0141	+0.0392
2-20-35	56	Right	0.8		21.2585	20.8006	20.9933	−0.4577	−0.2650	−0.1927	21.1250	20.7355	20.9602	−0.3895	−0.1648	−0.2247
		Left	0.6		21.2000	20.8572	20.9483	−0.3428	−0.2517	−0.0911	21.1833	20.8044	20.8986	−0.3789	−0.2847	−0.0942
2-21-35	57	Right	0.8		21.4162	21.1833	21.2177	−0.2329	−0.1985	−0.0344	21.4867	21.1021	21.2342	−0.3846	−0.2525	−0.1321
		Left	0.8		21.6310	21.2337	21.2584	−0.3973	−0.3726	−0.0247	21.7183	21.2174	21.3246	−0.5009	−0.3937	−0.1072
2-24-35	58	Right	0.7		17.8842	17.7141	17.8472	−0.1701	−0.0370	−0.1331	17.8400	17.7304	17.7644	−0.1096	−0.0756	−0.0340
		Left	0.6		17.9725	17.5649	17.6616	−0.4076	−0.3109	−0.0967	18.0553	17.6465	17.7278	−0.4088	−0.3275	−0.0813
2-27-35	59	Right	0.8		21.6282	21.4253	21.6321	−0.2029	+0.0039	−0.2068	21.6500	21.4416	21.5432	−0.2084	−0.1068	−0.1016
		Left	0.8		21.3656	21.3754	21.4220	−0.1904	−0.1438	−0.0466	21.5617	21.2779	21.3221	−0.2838	−0.2396	−0.0442
2-28-35	60	Right	0.7		18.7699	18.3469	18.3015	−0.3930	−0.4384	+0.0454						
		Left	0.7		18.7625	*	Eyeball not Enucleated	———	———	———						
2-28-35	61	Right	0.8		21.7958	21.2964	21.6146	−0.4994	−0.1812	−0.3182	21.6225	21.1826	21.6311	−0.4399	+0.0086	−0.4485
		Left	0.7		21.6967	21.6178	21.3557	−0.0788	−0.3410	+0.2622	21.7392	21.6522	21.7213	−0.0870	−0.0179	−0.0691
3-5-35	62	Right	0.8		21.1700	20.6588	20.9718	−0.5112	−0.1982	−0.3130						
		Left	0.7		21.0942	20.6822	20.8121	−0.4120	−0.2771	−0.1349						

* Delineation Indistinct

0.4001—0.5000 mm. = 3 cases
0.5001—0.6000 mm. = 1 case
0.6001—0.7173 mm. = 1 case

The average error was 0.2376 mm.

The difference between the *micrometer caliper measurement* of the *enucleated eyeball* and the *corrected roentgenographic measurement* of the corresponding *enucleated eyeball* varied from 0.0086 mm. to 0.6925 mm. The difference between:

0.0000—0.1000 mm. = 8 cases
0.1001—0.2000 mm. = 6 cases
0.2001—0.3000 mm. = 8 cases

0.3001—0.4000 mm. = 7 cases
0.4001—0.5000 mm. = 3 cases
0.5001—0.6925 mm. = 1 case

The average error was 0.2329 mm.

The difference between the *corrected roentgenographic measurement* of the *enucleated eyeball* and the *corrected roentgenographic measurement* of the corresponding *eyeball in situ* varied from 0.0107 mm. to 0.6277 mm. The difference between:

0.0000—0.1000 mm. = 11 cases
0.1001—0.2000 mm. = 9 cases
0.2001—0.3000 mm. = 3 cases
0.3001—0.4000 mm. = 2 cases
0.4001—0.5000 mm. = 2 cases
0.5001—0.6000 mm. = 2 cases
0.6001—0.6277 mm. = 1 case

The average error was 0.1882 mm.

Comment

Under the optimum of experimental conditions, the antero-posterior diameter of the cat's eye *in situ* was measured with a percentage error which varied from 0.028 to 3.59. This animal lends itself readily to this purpose.

The correction for roentgenographic distortion was computed by the procedure known as simple triangulation rather than by stereoscopic triangulation or parallax methods, because the former is technically less involved and is more accurate when the object-film distance can be measured.

We have used the procedure as described on eight human subjects immediately preceding enucleation. A general anesthetic was administered in two of the cases because of the age of the patients. The injection of diodrast was accompanied with pain of varying intensity and duration in five of the remaining six cases. In this series of cases the majority of the eyes were phthisical or had sustained a prolonged intraocular inflammatory process with involvement of the adjacent orbital tissue, a series in which one could not expect good results. We have, however, learned a number of facts and with the proper material will be able to determine whether or not this procedure, or a modification of it, can be made applicable in measuring the antero-posterior diameter of the human eyeball *in situ*. We desire to emphasize the statement that the procedure is still in the experimental stage, and technical improvements are being worked out.

It is our hope that others may become actively interested in this fundamental problem and that attendant enrichment of our ophthalmological knowledge will result from its solution.

References

Budin and Varnier. Obstetrique, 1897, v. 2, p. 499.
Hodges, P. C., and Ledoux, A. C. Roentgen-ray pelvimetry, Amer. Jour. Roentgenol., 1932, v. 27, pp. 83-96.

Discussion. DR. F. H. VERHOEFF: I should like to ask what was the influence of the difference of pressure in the eye *in situ* and when enucleated, and whether Dr. Katz made any test to find out how much size difference there was with differences in pressure. It might be a good method to ascertain elasticity of the eyeball.

DR. KATZ: In answer to Dr. Verhoeff's question, I should like to say we considered that problem.

When the eyeball was enucleated and placed on the concave upper surface of the disc it retained what we consider normal form.

DR. VERHOEFF: Wouldn't it be possible to give the eye a definite pressure?

DR. KATZ: That would be possible. We had not thought of it.

CONGENITAL AND ACQUIRED DEFICIENCIES OF FUSION

ALFRED BIELSCHOWSKY, M.D.

BRESLAU, GERMANY

In cases of that extreme type of deficiency of fusion called horror fusionis, diplopia sets in after a squint has been reduced by operation. The double images may be made to approach or even touch each other by the usual procedures, but fusion cannot be brought about. The patient whose case is reported had acquired convergent squint in 1916, when he was seven years old. In 1922 both eyes were operated on. In 1933 diplopia combined with severe headache, insomnia, and other troubles suddenly set in. Neither by three further operations nor by fusion exercises could the diplopia be removed. The very slight but unsteady deviation, due to a paretic weakness of almost all the muscles of the right eye, was composed of a lateral, a vertical, and a rotary component. Besides, spasms, occurring at irregular intervals, frequently altered the position of the eyes. Fusion could be obtained neither by prisms nor by the haploscope. Finally, a considerable difference in the relative size of the ocular images was ascertained, the correction of which by size lenses helped the patient to get binocular single vision with depth perception and fusional amplitude. Since then the patient has been entirely comfortable. Read before the New England Ophthalmological Society, in Boston, January 15, 1935.

The faculty to see single with two eyes is based on the intimate connection of the sensorial and the motor apparatus. Identical stimulation of corresponding retinal points produces a single sensation which is localized in one and the same direction and at the same distance as the fixated point, the images of which are situated on both the foveae. When the images of an object formed on peripheral retinal points attract attention, the motor apparatus begins to work like a reflex mechanism, the amount and direction of the movement of the eyes being determined by the distance between the foveae and such peripheral points, and by the direction of the latter relative to the foveae. The movements induced by the stimulation of corresponding parts of the retinae are always equal and parallel movements.

In near vision there are very few images which can be formed on corresponding parts of the retinae: the images of most objects are formed on noncorresponding (disparate) points. These objects are seen either double or single. In the latter case they do not appear at the same distance as the fixated point, but before or behind that plane —a postulate on which depth perception is based. The limits of the disparity compatible with binocular single vision vary in different individuals, but, as a rule, are relatively narrow. If the retinal images of an object attracting the attention have a disparity beyond those limits, either diplopia will arise or the fusion apparatus will begin to work and induce the eyes to move in opposite directions so that the disparate images of that object are transferred to corresponding areas and are fused before double vision is noticed.

The fusion apparatus, consisting of a sensorial and a motor portion, may be compared with a reflex mechanism. The centripetal stimulation will arise when the attention is attracted by an object formed on disparate retinal areas. Arrived at the cortex the stimulus will be conveyed to the motor centers of the fusion movements, as we will call the movements which transform a disparate pair of retinal images into a corresponding one. There are three antagonistic pairs of fusion movements: convergence and divergence taking place in lateral directions, positive and negative vertical divergence according as the right eye moves up or down or the left eye in the opposite direction, and finally conclination and disclination, as we will call, after Tschermak, the rotations of the eyes around the visual axes, according as the tops of the vertical meridians converge or diverge. It must be emphasized that both kinds of eye movements, the parallel as well as those fu-

sion movements which take place in opposite directions under normal conditions of seeing, obey the law that every motor impulse always goes equally to both eyes. The movements following the bilateral, equal innervation must be unequal, or even unilateral, when an impulse producing a parallel movement is combined with an impulse to move the eyes in opposite directions. In that case both impulses will drive one eye in the same direction, for instance the right eye to the right, while the left eye, by the dextroversion impulse, will be driven to the right but at the same time by a convergence impulse to the left so that the left eye will be moved less than the right eye, or not at all if both impulses are equally strong.

In orthophoria there occur, under the usual conditions of seeing, only the contralateral fusion movements which transform the parallelism of the visual lines into convergence, and conversely the latter into parallelism. The other fusion movements occur in orthophoria only when a lateral or a vertical displacement of the images of one eye or of both eyes in opposite directions is produced by means of abducting or vertical prisms or of the haploscope. But the amplitude of such fusion movements is relatively small when compared with the convergent movements because the latter, being used in near vision is—at least to a certain degree—dependent on the will, whereas the other fusion movements cannot be performed voluntarily but must be forced by one of the aforementioned methods. Their great importance for the visual act becomes evident in cases of heterophoria, which is present in at least 80 percent of human beings and which would cause diplopia unless the fusion apparatus prevented it by maintaining so-called compensating innervation. This overcomes an anomalous position of the eyes so that outlying objects may be formed on corresponding parts of the retinae.

The amplitude of the fusion movements is limited. However, the limits are not fixed, but differ even in one and the same normal individual according to whether he is fresh and attentive or tired and distracted. The range of fusion may be enlarged to a certain degree by practice, particularly if the fusion innervation is used from early childhood for compensating a phoria. Thus, for instance, I have seen patients who were able to keep a congenital vertical divergence of 20 arc degrees latent, whereas people with a normal balance of the vertical motors cannot overcome more than a few prism degrees. By testing the fusion amplitude in numerous normal individuals, an average amplitude for the particular fusion movements has been determined. Strong and healthy people have, as a rule, a larger amplitude than weak or exhausted people. But there are many exceptions to the general rule. Apparently healthy and strong individuals are occasionally observed who display an unusually narrow range of one or all of the fusion movements. The majority do not suffer from their weak fusion faculty, the sensorial apparatus in these cases being intact. But in some cases troubles of various kinds arise from a weak fusion faculty, and this is not only in cases of phorias which cannot be compensated, so that double vision results, but even in cases of orthophoria where, as a matter of fact, the weak fusion faculty in distant vision is not evident, but may be very annoying in near vision, due to an insufficiency of convergence. I am not going to discuss in in detail all the various troubles such patients complain of, the most frequent of which are eyestrain, diplopia, headache and nausea.

Let us consider the different factors which may cause an insufficiency or a complete deficiency of fusion. Without knowing the etiologic factor in a case, it is very difficult or even impossible to remove the patient's trouble. It is obvious from the very beginning, that the symptoms will be different according as to whether the centripetal or the centrifugal part of the fusion apparatus, or the intracortical link between the sensorial and the motor centers of the fusion movements may be involved. An equal stimulation of both the retinae, caused by an object the images of which are formed on disparate points, is

indispensable in producing any fusion movements. There are, of course, no fusion movements if one eye is blind or highly amblyopic. Even the convergence movement will disappear when the vision of one eye is lost or is considerably impaired by illness or injury. To bring about a fusion movement, the visual sensations arising from both the retinae must have nearly equal weight so that they may maintain themselves beside or against each other. If one eye is highly ametropic, or its refraction not adapted to the working distance, the sensations arising from that eye are instinctively suppressed and cannot participate in the production of fusion movements. In all such cases the deficiency of fusion does not, as a rule, cause any subjective troubles apart from the lack of depth perception and a more or less noticeable squint. In some cases, however, the images of the weaker eye, previously disregarded, thrust themselves more or less suddenly into consciousness, so that a very disturbing diplopia may result. This, not infrequently, follows squint operations which have left only a small fraction of the angle of squint, so that the retinal image of the object fixated by the other eye is formed on a spot close to the center of the squinting eye instead of on a peripheral place with a much lower visual acuity, which, during the squinting period, had received the same image as the macula of the fixing eye. We will have to come back to these cases later on. At present I am going to discuss the anomalies of fusion due to disturbances of the centrifugal (motor) part of the fusion apparatus. As a rule, these anomalies are acquired in a later period of life, in contradistinction to the disturbances of the centripetal (sensorial) part of the fusion apparatus, which are more frequently congenital or acquired in early childhood.

Motor fusion anomalies may be separated into several groups. To the first group belong persons who had never noticed diplopia previously, or at most temporarily. After a psychic shock or during a longer period of psychic excitement, anger, worry, and anxiety, or physical exhaustion due to a serious protracted illness, or to particular circumstances, such as the hardships of war, diplopia arises either suddenly and permanently from the very beginning or, in the first stage, temporarily, becoming permanent only gradually. I remember a patient, a high official, a very strong man in the prime of life. Previously he had never noticed diplopia or any other trouble with his eyes. He had noticed diplopia for only about a year and a half; in the beginning temporarily, then permanently. It worried him immensely, because he was unable to read and write for more than a few minutes without getting a severe headache. He was afraid of losing his position and was on the verge of despair. A thorough examination showed an ordinary hyperphoria of 3^{Δ}, the correction of which by vertical prisms removed all the trouble permanently, as I know from letters which he has sent me for many years. In the absence of any paretic signs the hyperphoria must have been pre-existent without causing any trouble during the previous life of the patient. The break-down of the fusion faculty occurred after a serious conflict with a superior official which upset him very much and deprived him of the faculty to overcome the slight hyperphoria, which previously he had been able to do without any effort. I have seen similar cases during the war, due to psychic shocks or long periods of hardship. Slight degrees of phorias had become manifest, the patients being unable to fuse the double images which were promptly and permanently fused by means of prisms. Thus, while the sensorial part of the fusion apparatus in these cases proves to be intact, the motor part does not respond to the sensorial stimulation and the fusion movement fails to set in. The fusion amplitude is either totally nullified, so that the patient cannot even overcome the weakest prism by a compensating innervation or—more frequently—the range of fusion is reduced to a small fraction of the physiologic average. Sometimes only one of the fusion innervations is affected, the other being normal or only slightly weakened, whereas in rare cases all the fusion

movements are affected equally or are abolished entirely.

From the fact that in the cases under discussion the ocular muscles function normally in parallel movements, it is evident that the trouble causing the lack of fusion movements must be localized above the motor nuclei. We have to assume a transcortical disorder involving the path between the cortical sensorial and the motor centers of the eyes. That this part of the cortex, containing the fusion centers and their connection with the visual centers, is exceptionally vulnerable, we understand from the fact that many people with heterophoria never notice diplopia as long as they are fresh and animated, but begin to see double as the first and frequently the only symptom of fatigue or of a narcotic. A slight change of the blood circulation seems sufficient to impair the functioning of the fusion apparatus.

There is another group of disturbances of that apparatus. In contradistinction to the first group, the patients belonging to the second group display a perfectly normal amplitude of fusion. There may be an insignificant heterophoria, or even orthophoria for distance. Though the patients are able to produce the physiologic maximum of convergence, they suffer from eyestrain and headache, which occur soon after starting near work. Refractive errors do not play any part in this trouble. Since the motor apparatus in such cases responds promptly to the fusion stimuli it is difficult to ascertain the origin of the subjective troubles. To be sure, there is always a marked neuropathic condition which may be responsible also for the eye trouble.

As to the treatment of deficiency of fusion movements, the greatest prospect of success is in cases in which the disturbance is due to physical exhaustion. Recovery from the latter, by appropriate living, may restore the fusion faculty even if the doctor takes no particular pains with fusion training. More frequently, however, one cannot dispense with exercises, which must be carried through for a long time. They are expedient, above all, in true cases of insufficiency of the convergence innervation. The most obstinate cases in regard to the effect of fusion training are those with small degrees of phorias which have become manifest due to a severe shock, a psychic depression, or excitation. The only efficient help will be obtained by prisms, which cannot be abandoned without an immediate return of the diplopia. It is a matter of course that in phorias of a higher degree, an operative correction must be considered. I must refrain here from going into the details of these cases, since I must return to the most important anomalies of the sensorial portion of the fusion apparatus, particularly to the so-called horror fusionis.

As was said before, one has to do in these cases partly with anomalies of congenital origin, partly with disturbances occurring at an early period of life and combined with one type or another of manifest strabismus. Diplopia, as a rule, being absent either because of an amblyopia of the squinting eye, or because of a suppression of its retinal images, may be elicited by means of a strong prism and a dark glass which weakens the images of the fixating eye to such a degree that the images of the squinting eye, simultaneously with those of the other eye, may come into consciousness. In the great majority of cases the relative position of the double images to each other does not correspond to the direction and the angle of squint, but points to an anomalous retinal correspondence adapted to the strabismus. But only a few patients make use of such an anomalous correspondence, which helps them to a sort of rudimentary binocular single vision. More frequently there is only monocular vision, the images of the squinting eye being entirely suppressed, at least those corresponding to the images formed in the center of the retina of the fixating eye. The suppression develops just as well in cases of squint with normal retinal correspondence, provided that the squint is a concomitant one and has developed in early childhood. The different types of conditions just discussed lead to an understanding of the different behavior of the visual act after

the squint has been removed or considerably reduced by operation. In a small number of patients binocular single vision will be obtained spontaneously, or after some fusion exercises. In other cases, in which a fraction of the angle of squint has remained, unilateral suppression will return after a short period of diplopia, unless prevented by amblyoscopic or haploscopic exercises which, of course, will be of use only in cases in which normal retinal correspondence is pre-established. Finally, there is a group of cases, fortunately rare, in which is displayed the phenomenon of horror fusionis. These patients, as a rule, have a very small angle of squint, amounting mostly to a few degrees; thus the double images are very close but unsteady with regard both to the distance and their position relative to each other. The double images may be made to approach, even touch or partly overlap each other, by means of prisms or of the haploscope, but fusion cannot be brought about. While a rotary prism held before the squinting eye should produce a purely lateral displacement of the retinal image so that it approaches the fovea, the patient will often see it move above or below the other image to the opposite side. Since the same phenomenon will be obtained in such a case by a very careful examination with the haploscope, only one explanation is possible: the patient changes the angle of squint instinctively, shirking a position of his eyes in which the images of the fixated object would be situated on identical retinal points. It seems as if two identical foveal images localized in the same direction without being fused cause such an uncomfortable feeling that the patients, without knowing it, endeavor to avoid it by changing the angle of squint. In the majority of such cases the disturbing diplopia disappears sooner or later. But there are patients who suffer greatly from diplopia for months and years. They may cause the doctor, whom they reproach with not having told them before the operation about a possible diplopia afterwards, a lot of trouble. In order to prevent such trouble one ought to consider in every case in which there is good or passable visual acuity of the squinting eye, the possibility of postoperative diplopia. A thorough examination will show whether there is a normal or an anomalous localization of the retinal images, and in the former case, whether one can get fusion by transferring the image of the fixated object in the squinting eye from the periphery of the retina to the macula, which can best be done by means of the haploscope or of the phorometer. If one cannot induce fusion, but instead gets diplopia, displaying a very unsteady position of the squinting eye, a possible postoperative diplopia due to horror fusionis must be discussed with the patient. One is inclined to believe that horror fusionis is evidence of a defective development of the sensorial correspondence of the eyes. There are, indeed, patients with squint who fixate alternately with either eye while the retinal images of the squinting eye are suppressed, who cannot be induced in any way to see two images of one object at exactly the same time, but who notice them at different places, one immediately after the other. Such patients do not make use of either a congenital normal or an acquired anomalous retinal correspondence. Their two eyes do not present the halves of a single organ—Hering's "Doppelauge"—but two organs which, in regard to the sensorial apparatus, are independent of each other. The frequency of these cases, I am sure, has been overestimated. An apparent horror fusionis may be due to a long-lasting disuse of one eye and the fusion faculty may be capable of being developed by proper training and by a most careful removal of anything which may cause an inferiority of the visual acuity of one eye.

I should like to describe and to discuss a patient as a striking example of how the fusion faculty in an apparently very serious case of horror fusionis could be developed almost completely. Mr. V., 25 years of age, an architect from South America, had a convergent strabismus which first appeared after a blow on the head when he was 7 years old, at which time one eye was

bandaged for about a week. He was given glasses at nine years of age. In 1922, when he was thirteen, his left eye was operated on; twenty days later, his right eye. During the following eleven years the right eye was said to have been blind. Apart from that the state of his health was excellent. He was a strong fellow and practiced all sorts of sports, and in addition studied hard. Not until November, 1933, did diplopia suddenly set in, combined with severe frontal and occipital headaches and pain in the neck. Besides, there were attacks of dizziness and bilateral blindness lasting from 10 to 15 minutes. Since then he has no longer been able to work; he has lost weight to an amount of 32 lbs., and has suffered from insomnia. In April, 1934, he came to New York. Repeated and careful general and neurologic investigations revealed no pathologic condition. Several Wassermann tests of the blood and spinal fluid were negative. The attacks of blindness were removed by medication and did not return. Because of the diplopia he was operated on three times in May and July, 1934, by a New York consultant, who, respectively, advanced or shortened the right superior oblique and resected first the right internal, and five weeks later the right external rectus. Since the diplopia continued, Mr. V. was referred to another consultant, who started fusion training exercises without success. Then the patient was referred to the New York Eye and Ear Infirmary where a certain amount of aniseikonia was found but one could not get an exact measurement because of the diplopia. Two months ago (in October, 1934), the patient was sent to the Department of Research in Physiological Optics in Hanover. Professor Ames was kind enough to ask me to make a thorough examination of the patient's motor anomalies. The visual acuity of either eye was normal after correction had been made of a small amount of hyperopic astigmatism, which was a little higher in the right eye. The fundi did not show any pathologic conditions. There were scars above the insertion of the internal and external recti muscles of both eyes. Looking straight ahead, the eyes appeared to be parallel. When ordered to look up and in there was a suggestion of either eye lagging behind the other, which moved a little further up and out. Moreover, the right eye did not move down and to the right so far as the left eye did. This would indicate a slight weakness of both the inferior oblique and the right inferior rectus muscles.

Diplopia was tested in several ways, by using the Maddox tangent scale, a tangent screen, and the haploscope, particularly the latter, in order to determine exactly the kind and amount of meridional deviation (declination). Without going into details of the numerous examinations, I shall relate only the most essential points, because of their diagnostic value. The patient has facilitated the numerous and tiresome examinations considerably by his interest and intelligence. All his statements were precise and reliable, as could be verified by comparing them with objective determinations of the position of the eyes. His faculty to observe and describe the exact position of the double images relative to each other, without the usual differentiation, was of the greatest importance, since a red glass or the Maddox rod, or anything else put before one eye, always caused a change of the diplopia, corresponding to a change of the relative position of the eyes. On the whole, the latter was unstable, as was ascertained by numerous examinations under equal conditions. The instability concerned all the components of the anomalous position of the eyes, and manifested itself in the position of the double images relative to each other (fig. 1). The double images of a distant object straight in front of the patient showed a small lateral homonymous and a vertical displacement, indicating a slight convergence and positive vertical divergence (right hypertropia). Besides, one or both of the images were oblique, indicating a conclination, as we call the convergence of the upper ends of the vertical meridians.

The patient preferred to fixate with

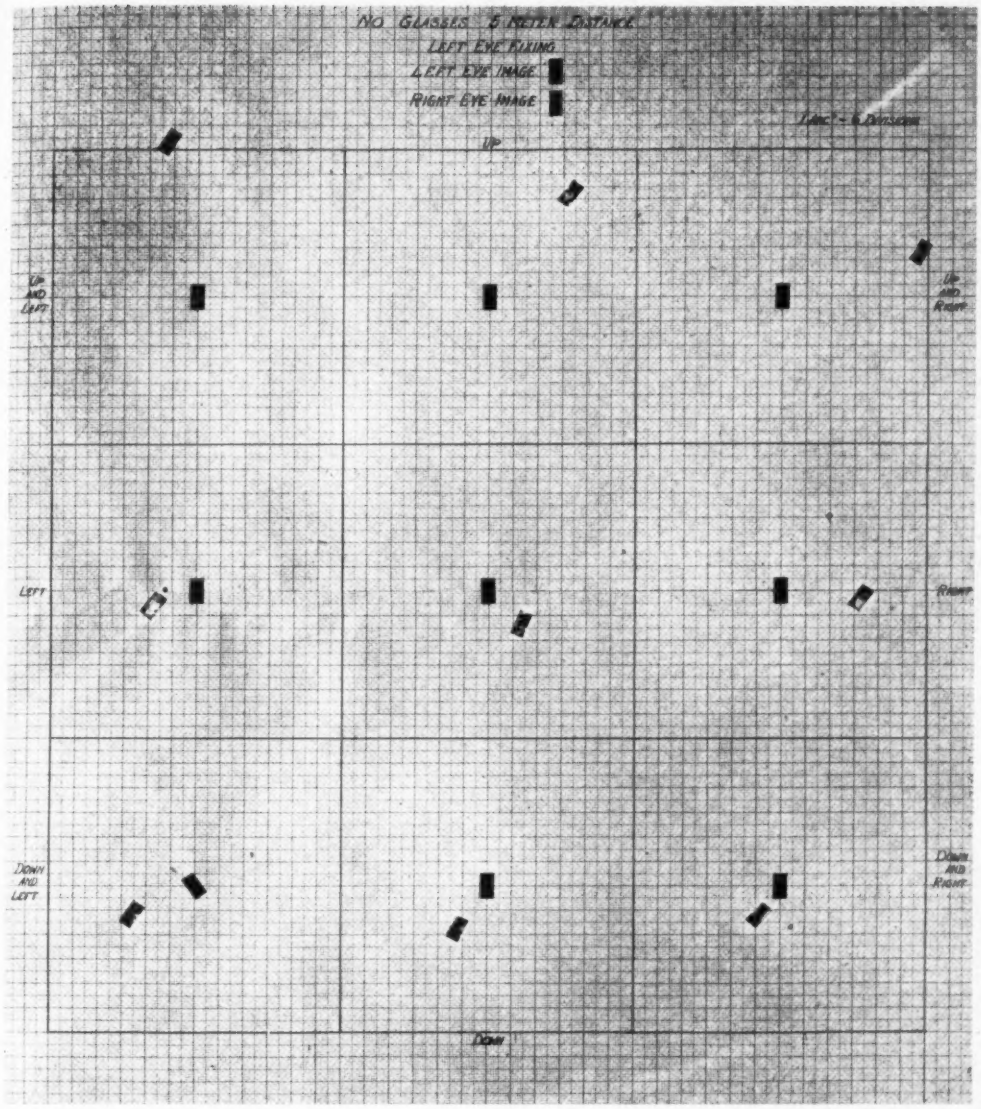


Fig. 1 (Bielschowsky). Double images in the different parts of the field of fixation.

the left eye, but was able to alternate spontaneously or at word of command. When the fixation impulse was transferred to the right eye the single components of the deviation changed, and that only a little in the primary position but considerably in some secondary positions of the eyes. A red glass put before one eye increased the lateral component of the deviation considerably, without affecting the vertical divergence. Dextroversion always caused an increase of the convergent component, whereas a moderate levoversion made the lateral distance of uncrossed double images disappear, and further movement to the left produced crossed diplopia, from which one had to conclude a paretic weakness of both the right external and the internal rectus. The vertical and the meridional components were not influenced at all, or were only slightly influenced by the lateral movements of the eyes. In the upper half of

the field of fixation, the convergent component increased considerably, the positive vertical divergence being transformed into negative vertical divergence of a high degree, the right visual line lagging behind, particularly in the left upper quadrant, whereas in the right upper quadrant the vertical divergence became rather small. From this behavior one must conclude a considerable paresis of the right inferior oblique, and a slight paresis of the right superior rectus. In the lower half of the field of fixation the convergence was transformed into divergence; the positive vertical divergence increased slightly in looking down, still more in looking down and to the right, and less in looking down and to the left. It showed a pronounced difference according to which eye was fixating, increasing if the right eye took the fixation. So one had to assume that the function of the right inferior rectus was weakened. The conclination of the vertical meridians causing obliquity of the double images was carefully examined with the haploscope in the different parts of the field of fixation. It was ascertained that the right eye was rotated around the visual axis much more than the left eye, the vertical meridian of which was found to be either exactly vertical or very slightly inclined in or outward. Repeated examinations showed the same, or even more fluctuations of the torsion than of the other components of the deviation. While the patient observed the double images of a horizontal strip, even without changing the direction of view, first one and then both images appeared oblique, sometimes moving to and fro around the sagittal axis.

Tilting of the head towards one shoulder produced a considerable change of the angle of torsion. The conclination was increased by tilting the head to the left, and decreased or even transformed into disclination by tilting to the right. But in contrast to the cases of simple paresis of an oblique muscle, in the case of Mr. V. the tilting of the head did not influence the vertical and the lateral distance of the double images, or only to a slight extent, provided that during the test the visual lines retained their direction and that, when the patient tilted his head, the visual field rotated around the same axis and through the same angle as did the head, conditions which may be ascertained by using the little apparatus devised by Hofman and myself for this purpose[1]. The peculiar unsteadiness of the anomalous position of the eyes, manifesting itself in the quite extraordinary fluctuations of the double images, suggested from the very beginning that in this case there was not only a postoperative or a congenital paresis of quite a number of muscles, but, moreover, that there existed spasms of all the innervations governing the ocular movements against each other, the lateral as well as the vertical and the torsion movements.

The spasms of the different muscle groups came and went at irregular intervals, they changed places or combined with each other, so that apparently there was no position of rest whatever. In most cases of multiple bilateral muscular paralyses, with a secondary contracture of not too high degree, there is a narrow part of the field of fixation where an object can be seen single, particularly with the aid of a certain posture of the head. Mr. V. showed, according to the direction of his visual lines and to the position of his head, homonymous or crossed diplopia, with positive or negative vertical divergence, and conclination of a higher or a very small degree, or even disclination. In such case, the patient should have been able to see single an object at a certain place in the field of fixation, and with a certain posture of the head, if the **paretic** disturbance had been the **only** cause of the diplopia. All experiments and efforts on the part of Mr. V. to get the double images fused were unsuccessful. By means of prisms or of the haploscope one could make the double images touch or even partly overlap each other, but all the different and innumerable experiments to help the patient to get

[1] Bielschowsky, A. Lecture on Motor Anomalies of the Eyes. II. Paralysis of individual eye muscles. Arch. of Ophth., 1935, v. 13, January, p. 42.

fusion failed. He seemed to be a typical representative of the anomaly called horror fusionis, all the more since he had squinted from childhood and diplopia had arisen only after the angle of squint had been reduced considerably. Why the diplopia did not occur immediately after the second operation but eleven years later is a question I am not yet able to answer. Further operative treatment could not be considered, orthoptic training had been unsuccessful, but the patient longed for relief in order to resume his studies. I gave him spectacles with a prism of 10 degrees base out before the right eye, combined with a convex lens of +8D. before the left eye, by way of experiment. They gave him some relief by blurring one of the double images and by displacing it toward the periphery of the visual field. When he had worn these glasses for one day the patient stated that the diplopia actually did not worry him so much as before but that the headaches were the same as previously. I was now at my wits' end and surrendered the patient to Professor Ames, though I did not believe that, by hook or by crook, Mr. V. could be helped more than by the aforementioned spectacles. Fortunately I met with a very gratifying disappointment.

I cannot enter here into the extraordinarily difficult and trying examinations that continued for several weeks with several interruptions. I shall confine myself to giving an account of the most important phases of the examination and of the means by which the good result was achieved. That the patient had a considerable difference in the relative size of the ocular images was easily ascertained. After correction of his refractive error, a black square at a distance of 15 feet appeared larger when seen with the right eye than with the left. A magnifying (size) lens in front of the left eye producing an overall enlargement of 5 to 7 percent equalized the two images approximately. After a series of tests with magnifying (size) lenses, a combination of 5 percent overall with 5 percent meridional enlargement axis 90° before the left eye helped the patient, for the first time, to get fusion of objects within a small central area of the visual field at a distance of 15 feet as well as at 10 inches. But to get and to maintain fusion the patient had to turn his head a little to the left and to tip it backwards and toward the left shoulder. As soon as the position of the head was changed, even slightly, or fixation was changed from the left to the right eye, diplopia returned, as it likewise did when the glasses were removed. Stereoscopic pictures were fused, but without depth perception. A prism of half a prism diopter held before one eye in any direction caused diplopia. Change of size lenses was tried. Some increased and some decreased the field of single vision. After the patient had worn the apparently best correction over night he reported on the following day that he still had headaches. The field of binocular single vision was smaller than on the day before. An exact determination of the size difference by means of the Ames ophthalmo-eikonometer was thwarted by the anomalous posture of the head, with which the patient could not dispense without losing fusion, and also because the patient could get fusion only when fixating the center and not when fixating the other significant points on the screen, where judgments

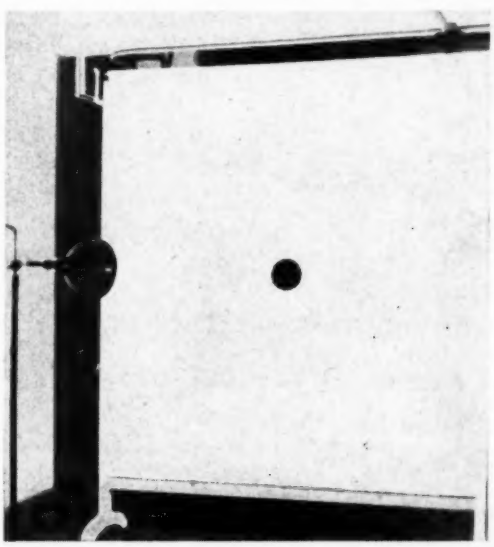


Fig. 2 (Bielschowsky). Ophthalmo-eikonometer screen.

Fig. 3 (Bielschowsky). Headband test with two lights and two screens at right angles.

were necessary for determining the amount of aniseikonia (fig. 2). The patient, who had to return to New York with the glasses mounted in a frame, was able to see single for two days, if there was no movement of objects in the visual field. The third day he could no longer obtain fusion and discontinued using them. When he came back to Hanover ten days later he had no fusion with his glasses. But in view of the fact that fusion had been obtained with a correction of the aniseikonia, it was thought that if the anomaly could be corrected more accurately the patient would possibly obtain better and lasting fusion. The patient was tested on the Ames ophthalmo-eikonometer, but the results were not satisfactory. Accordingly, another way had to be devised.

During earlier examinations, when the size corrections that gave the patient fusion were slightly changed, he had to change the position of his head to obtain fusion again. Moreover, repeated size corrections changed the angle of squint in an apparently inconsistent manner. This led us to believe that a correction could be found that would give the patient fusion, not only with his head in the primary position, but with a minimum amount of heterophoria. A test had to be devised in order to find the aniseikonic correction by which the anomalous position of the head could be transferred gradually to the normal position without breaking the fusion. To accomplish this task, a definite knowledge of the exact position of the patient's head was necessary. For this purpose two lights which projected images at right angles to each other, were mounted on a headband which the patient wore (fig. 3). With chin supported on a chinrest and with head in the primary position one light was focused on the center of a tangent screen five feet in front of the patient. The other was focused on the center of a tangent screen five feet to the right forming an angle of 90 degrees with the front screen. The position of the two light images on the two screens allowed us to read off exactly whether and at which angles the position of the head deviated from the primary position. The fixation object was a little lamp at the center of the front screen. A movable white wooden strip, the width of the tangent scales, was pivoted at the center of the screen. It was used to determine the meridians of declination. With the size correction slightly different from that which first gave the patient single vision he was able to fuse with considerable effort with his head in a parti-

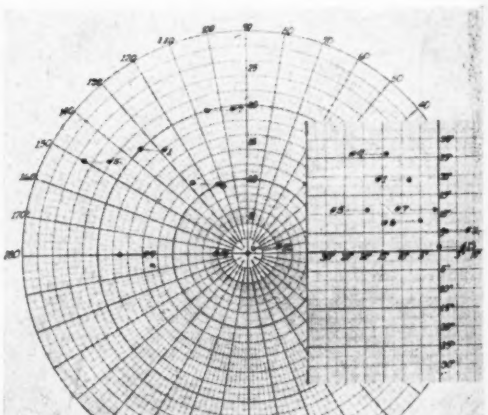


Fig. 5 (Bielschowsky). Graphic illustration of the positions of the head which help to obtain fusion with the different size corrections.

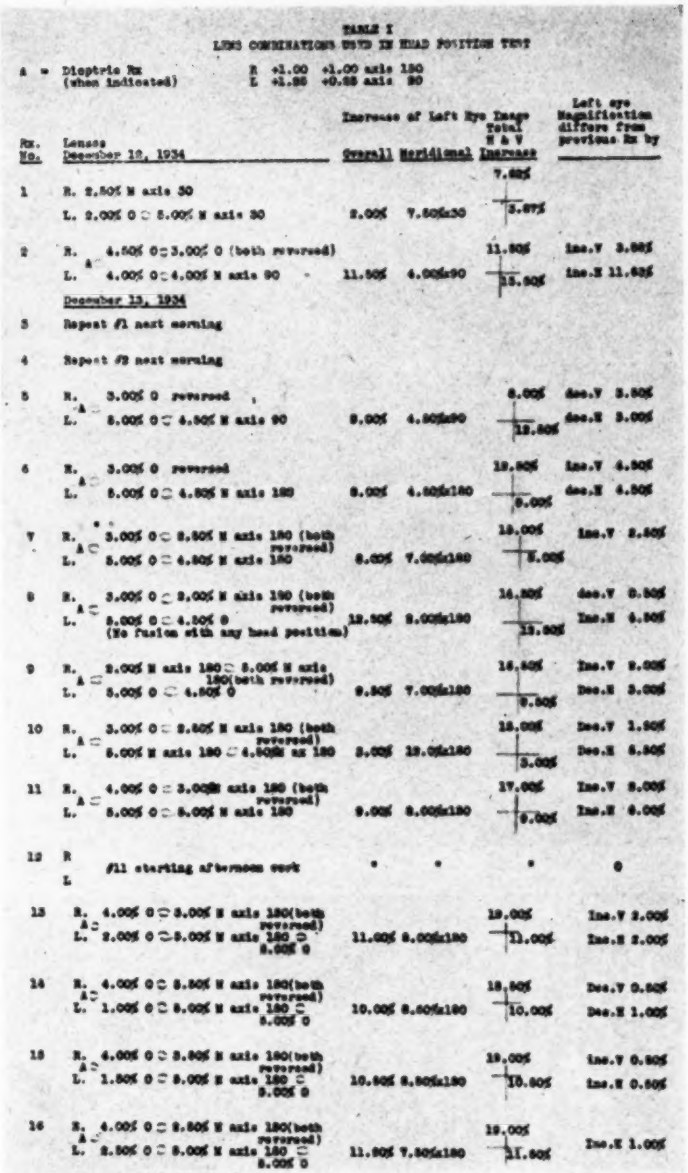


TABLE I

LENS COMBINATIONS USED IN HEAD POSITION TEST

A = Dioptric Rx (when indicated) R +1.00 +1.00 axis 180
L +1.50 +0.50 axis 90

Rx. No.	Lenses December 10, 1934	Increase of Left Eye Overall	Meridional	Image Total H & V	Left eye Magnification differs from previous Rx by
1	R. 2.50% N axis 90			7.50%	
	L. 2.00% 0 ⊃ 5.00% N axis 90	2.00%	7.50%x90	5.00%	
2	R. 4.50% 0 ⊃ 3.00% 0 (both reversed)			11.50%	Ine.V 3.00%
	L. 4.00% 0 ⊃ 4.00% N axis 90	11.50%	4.00%x90	15.50%	Ine.N 11.50%
	December 13, 1934				
3	Repeat #1 next morning				
4	Repeat #2 next morning				
5	R. 3.00% 0 reversed			8.00%	Dec.V 3.50%
	L. 5.00% 0 ⊃ 4.50% N axis 90	8.00%	4.50%x90	12.50%	Dec.N 3.00%
6	R. 3.00% 0 reversed			12.50%	Ine.V 4.50%
	L. 8.00% 0 ⊃ 4.50% N axis 180	8.00%	4.50%x180	8.00%	Dec.N 4.50%
7	R. 3.00% 0 ⊃ 2.50% N axis 180 (both reversed)			10.00%	Ine.V 2.50%
	L. 5.00% 0 ⊃ 4.50% N axis 180	8.00%	7.00%x180	5.00%	
8	R. 3.00% 0 ⊃ 2.00% N axis 180 (both reversed)			14.50%	Dec.V 3.50%
	L. 8.00% 0 ⊃ 4.50% 0 (No fusion with any head position)	12.50%	8.00%x180	13.50%	Ine.N 4.50%
9	R. 2.00% N axis 180 ⊃ 3.00% N axis 180(both reversed)			16.50%	Ine.V 2.00%
	L. 5.00% 0 ⊃ 4.50% 0	9.50%	7.00%x180	9.50%	Dec.N 3.00%
10	R. 3.00% 0 ⊃ 2.50% N axis 180 (both reversed)			18.00%	Ine.V 1.50%
	L. 8.00% N axis 180 ⊃ 4.50% ax 180	8.00%	12.0%x180	5.00%	Dec.N 6.50%
11	R. 4.00% 0 ⊃ 3.00% axis 180 (both reversed)			17.00%	Ine.V 3.00%
	L. 8.00% 0 ⊃ 5.00% N axis 180	9.00%	8.00%x180	9.00%	Ine.N 4.00%
12	R #11 starting afternoon work L	•	•	•	0
13	R. 4.00% 0 ⊃ 3.00% N axis 180(both reversed) L. 2.00% 0 ⊃ 5.00% N axis 180 ⊃ 5.00% 0	11.00%	8.00%x180	19.00% 11.00%	Ine.V 2.00% Ine.N 2.00%
14	R. 4.00% 0 ⊃ 3.50% N axis 180(both reversed) L. 1.00% 0 ⊃ 5.00% N axis 180 ⊃ 5.00% 0	10.00%	8.50%x180	18.50% 10.00%	Dec.V 0.50% Dec.N 1.00%
15	R. 4.00% 0 ⊃ 3.50% N axis 180(both reversed) L. 1.50% 0 ⊃ 5.00% N axis 180 ⊃ 5.00% 0	10.50%	8.50%x180	19.00% 10.50%	Ine.V 0.50% Ine.N 0.50%
16	R. 4.00% 0 ⊃ 3.50% N axis 180(both reversed) L. 2.50% 0 ⊃ 5.00% N axis 180 ⊃ 5.00% 0	11.50%	7.50%x180	19.00% 11.50%	Ine.N 1.00%

Fig. 4 (Bielschowsky). Combinations of size lenses numbered and listed.

cular position. He had, as he said, to hold his breath for fear fusion would be lost, and he had a sensation of pulling in the superior and inferior orbital margins of the right eye. The size corrections were then changed in small steps. The combinations of size lenses used in this test have been numbered and listed (fig. 4). Their effect on fusion, or the position of the eyes, respectively, has been graphed (fig. 5). The chart shows the positions of the head which helped to obtain fusion with the different size corrections. For instance, with correction No. 7 the patient had fusion if his head was thrown back (chin elevated) at an angle of 20 degrees, besides being turned to the left 5 degrees and

tilted toward the shoulder 12 degrees. With correction No. 9 the head was not thrown back any more, but turned to the left 17 degrees and tilted toward the shoulder 26 degrees. With correction No. 12, not shown in figure 5, the patient obtained fusion at first if the eyes

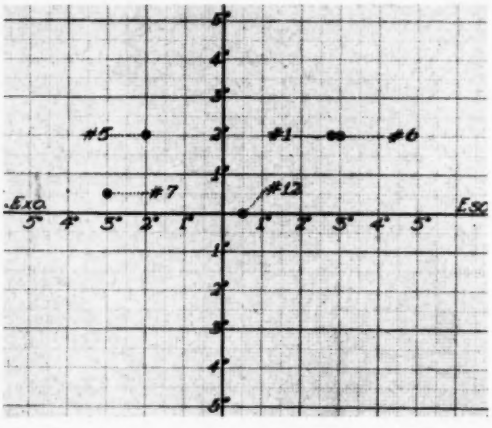


Fig. 6 (Bielschowsky). Effect of different size lenses on the position of the double images, with the head in primary position.

were raised or the head thrown back at an angle of 10 degrees. But he could maintain fusion while he moved his head so that the fused image was brought to the center of the screen. The head was in the normal position except for a tip to the left of 1.5 degrees.

Figure 6 will demonstrate the effect of different size lenses on the position of the eyes or on the double images respectively, with the head in the primary position. With correction No. 14 (not shown in figure 5) the patient, with the head in normal position, could change fixation from the left to the right eye without losing fusion. He maintained fusion while the head was moved a little to the left and to the right or was elevated or depressed, or tilted to either side. But only with the last correction was he able to see single without feeling a strain; however, only in a relatively small area of the field of fixation and if he was not farther than ten feet away from the screen. A prism of one degree held before one eye in any direction broke fusion. Wearing that correction the patient could be tested on the ophthalmo-eikonometer for the first time, because with it he could hold fusion not only when looking at the disc in the center, but also when looking at the lights and dots in the periphery of the screen. The tests on the ophthalmo-eikonometer showed that the correction as above obtained corrected almost exactly the patient's aniseikonia. The fusion faculty for reading was improved so that the patient finally was able to read the smallest type on the Jaeger card. With the new correction, however, he could maintain fusion only within a distance of 13 feet. A repeated examination on the ophthalmo-eikonometer showed that the punctum remotum of the eyes was not at the same distance. To equalize the ocular images, the convex lens (0.5D.) before the right eye had to be discarded. A further small change in the size lenses, by decreasing the magnification in the vertical and increasing it in the horizontal meridian, achieved single vision, without effort, of near and distant objects even when those objects were in motion. Now he had to make an effort to see double images. The peculiar pulling sensation in the orbital margins had disappeared. He went to a moving picture show and did not lose fusion at any time. He was able to read and write for several hours without getting headache or eyestrain. He no longer suffers from insomnia. For the first time in his life he has achieved depth perception, though not of the highest degree, when tested with stereoscopic pictures. He is now wearing: R.+1.12 D. sph. ⌯ +1.00 D. cyl. axis 150°; L. +1.25 D. sph. ⌯ +0.25 D. cyl. axis 20° ⌯ 11% (magnifying lens) overall ⌯ 4.5% meridional axis 150°. When wearing these glasses there can be disclosed just 0.5 degrees of exophoria; he has binocular single vision in the whole field of fixation which his spectacles allow him to encompass, whereas without the correction the diplopia is about the same as previously in the different parts of the field of fixation. The patient has worn the correcting glasses since the middle of December, 1934. I saw him the last time on the first of May, 1935. He feels very comfortable and is happy because he can work as much as he likes, which

he had been unable to do during a period of about a year and a half.

The fusional amplitude measured with the haploscope was 6 arc degrees, both for convergence and divergence, and 2 arc degrees for both positive and negative vertical divergence. When tested with prisms the fusional amplitude was found to be much smaller. The patient could overcome a prism of not more than 2^{Δ} base out, in, up, or down, and even that only after he had had his fusion faculty trained by means of the haploscope. This fact must be considered in similar cases, because a possible aniseikonia may be introduced by looking through flat prism glasses on account of the distortion they produce, whereas the size of the ocular images of the haploscope targets seen in the mirrors is not altered at all.

In all cases in which aniseikonia has been corrected heretofore, the size and shape of the ocular images of the two eyes have been compared and the size correction given was that which equalized them. In the case just discussed the size correction selected was that which corrected the squint and at the same time the anomalous head position. When this correction was checked on the ophthalmo-eikonometer, it was found that it very closely equalized the difference in the size and shape of the ocular images. This case is the first in which aniseikonia has been determined, not on the basis of equalizing the size and shape of the ocular images, but on the basis of correcting anomalous ocular and head positions.

I have discussed this case rather at length because it has—in my opinion—a fundamental significance. Anyone who has had to deal with such a serious case of horror fusionis will know that hitherto it has very often been futile to expend time and pains on it in order to obtain binocular vision. In the end one had to be satisfied, as a rule, with achieving a tolerable condition by blurring one of the double images, or by shifting it into the periphery of the visual field. One took it for granted that the anomaly, in such a case, was due to a congenital, and therefore irreparable defect of the cortical part of the fusion apparatus. Apart from the lack of the fusion faculty, our case was complicated by paretic conditions resulting in a deviation made up of a lateral, a vertical, and a torsion component, changing with the slightest alteration of the direction of view. Such behavior must make the unfavorable prognosis still worse because it prevents, as a rule, the development of a suppression which, in other cases of that type, makes the diplopia disappear sooner or later. Therefore, when I considered the complicated motor anomalies existing in this case, and the apparently entire absence of the fusion faculty, I could not imagine how the correction of a possible difference in the size of the retinal images might produce not only binocular single vision, but also a considerable amount of fusional amplitude.

I am very glad to have had the opportunity of attending the further examination made by Professor Ames and his staff, particularly Mr. Madigan, and to watch the gradually developing evidence of a causal connection between aniseikonia and the deficiency of fusion, the re-establishment of which by means of the size correction, is an irrefutable proof of that connection. In the reported case we had to deal not only with an isolated and exceptionally interesting case, but with one of fundamental importance. Henceforth we shall have to look, in every case of weak or defective fusion, for anisikonia as a possible origin of the fusional anomaly. Aniseikonia seems to be an important etiological factor, not only in so far as it involves an incongruence of the ocular images, like ametropia or other conditions impairing the visual acuity, but because it may produce anomalous nervous irritations, as well as a weakening of the physiologic fusion mechanism, either in its sensorial portion, by favoring suppression, or in the motor portion, by checking the fusion innervation on account of a mental antipathy toward the fusion of heterogeneous ocular images. Further clinical experiences, I am sure, will enlighten us on the part aniseikonia plays in the etiology of fusion anomalies and of strabismus.

Kleinburgstrasse 15.

OCULAR COMPLICATIONS IN NEUROBLASTOMA

P. J. LEINFELDER, M.D.
IOWA CITY

Hutchinson, in 1907, described the clinical syndrome of neuroblastoma of the adrenals, but the pathologic interpretation of the disease was not established until several years later. The disease, because of orbital metastases, is among the many causes responsible for exophthalmos. Neuroblastoma is not of frequent occurrence but the clinical picture is quite distinctive. The fatal, rapidly progressive disease of early childhood is characterized by hydrocephalus, exophthalmos, secondary anemia, and emaciation. The clinical and pathologic manifestations of the disease are discussed and three new cases are presented. From the Department of Ophthalmology, College of Medicine, State University of Iowa.

The syndrome of ecchymosis of the eyelids, exophthalmos, hydrocephalus, secondary anemia, and cachexia, occurring in children with malignant tumors of the adrenal, was described in 1907 by Hutchinson[1]. He, and later Tileston and Wolbach[2], described the tumor as sarcoma, but Frew[3] believed it to be a carcinoma of the medullary portion of the gland. Wright[4], in 1910, showed that these tumors were neuroblastomas, arising from embryonic elements of the sympathetic nervous system which form the medullary portion of the adrenals. Wahl[5], in 1914, presented a detailed report of three histologic types of neuroblastoma. A survey of the literature on the pathology of such tumors was made by Lehman[6] in 1917. More recently Geschickter[7] has studied these tumors and described their pathology.

Ocular complications are found only in the Hutchinson type of neuroblastoma; i.e., the type in which metastases occur in the orbit, skull, meninges, and long bones. Another type, described by Pepper[8] in 1901, has no ocular manifestations, since metastases occur primarily in the liver. In the third type the metastases may be absent or may occur almost anywhere in the body. In 1933, Scott, Oliver, and Oliver[9] collected from the literature 158 cases of neuroblastoma of which 38 were of the Hutchinson type. Lewis and Geschickter[10] reported 40 additional cases in 1934 without classifying them according to type.

Three cases of neuroblastoma with metastases to the skull have been observed in the University Hospital, State University of Iowa. This type is said to occur most frequently in younger children, in contradistinction to the Pepper type, which develops in infants and is without ocular manifestations.

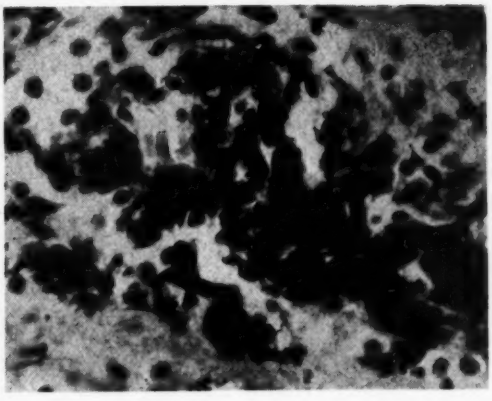
Report of Cases

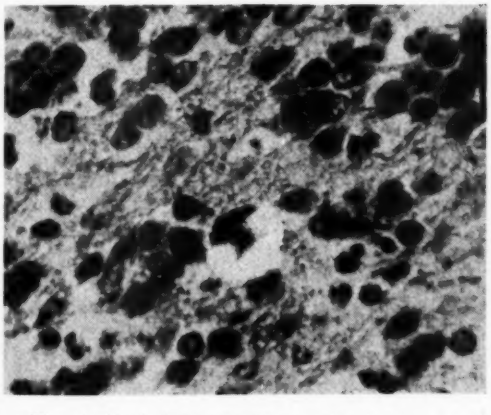
Case 1. R. S., a male child, 4 years of age, was admitted on September 2, 1932, because of rapidly increasing prominence of both eyes (fig. 1). Proptosis of the left eye had been first noted one month previously, and soon thereafter the right eye became involved.

The child appeared undernourished, but physical examination revealed only the proptosis and enlargement of the head to a circumference of 52.5 cm. Both upper lids were discolored as if by old ecchymoses and both eyes were proptosed, the exophthalmometer reading being 22 mm. on the right and 25 mm. on the left. Ocular rotations, especially of the left eye, were limited in all directions. The right pupil was round, 4 mm. in diameter, and reacted normally, while the left was dilated to 6 mm. and reacted sluggishly. There was bilateral papilledema, more pronounced on the left side. The blood picture was that of moderate secondary anemia, and the urine was normal. The Wassermann reaction was negative. The sella turcica could not be visualized in the roentgenograms because of a soft-tissue tumor in the left sphenoid region which involved the roof of the left orbit.

A piece of soft hemorrhagic tumor tissue that had eroded the roof of the left orbit was removed at biopsy. The sections* showed proliferation of extremely small malignant cells with

* Pathologic description by Dr. C. F. Geschickter.





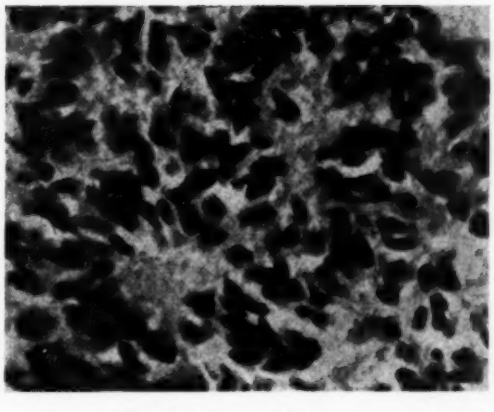


Fig. 1 (Leinfelder). The patient in case 1 at the time of his first admission.

Fig. 2 (Leinfelder). Photomicrograph of tissue removed from the orbit in case 1.

Fig. 3 (Leinfelder). The patient in case 2 at the time of admission.

Fig. 4 (Leinfelder. X ray of skull in case 2. The sutures are widely spread, there is osteoporosis, and lines of calcium (whiskers) extend from the upper part of the skull.

Fig. 5 (Leinfelder). Photomicrograph of tissue removed in case 2. A rosette is seen in the lower left.

Fig. 6 (Leinfelder). Photomicrograph of lymph node removed in case 3, showing cell detail and rosettes.

dense nuclei and scanty cytoplasm (fig. 2). They grew in clumps with a large amount of fibrous stroma. No definite rosette formation was seen. An unusual degree of variation in the size of the nuclei was present; this suggested neuroblastoma rather than Ewing's sarcoma. The impression received from the microscopic section was that of neuroblastoma.

Following roentgen-ray therapy to the temporal regions the proptosis decreased gradually and on November 11, 1932, the exophthalmometer readings were 15 and 17.5 mm.

On February 12, 1933, the boy was readmitted in a clinical condition. He was emaciated and unresponsive. Both eyes were greatly proptosed, and the chemotic conjunctiva protruded between the swollen lids. Rotations were practically absent and the fundi could not be seen. The veins of the skull were dilated and the sutures were spread and easily palpated. There was a soft-tissue tumor, measuring 3 x 5 cm. in the left fronto-parietal region, and other smaller tumors on the skull. A firm mass infiltrated the submaxillary region on each side, and spongy new tissue replaced the gums. There was adenopathy in the cervical and inguinal regions and the liver was enlarged, but the spleen was not palpable. Blood studies revealed an advanced secondary anemia. Roentgenograms showed wide separation of the sutures of the skull and osteoporosis of the vault, pelvis, and long bones. Extending outward from the surface of the long bones were fine perpendicular lines of calcification.

Remittent fever developed and the condition of the child became progressively worse. The head increased to 55.5 cm. in circumference, the tumor in the fronto-parietal region enlarged, and a fungating mass, arising from the left upper lid, occluded the eyeball. Ulceration and destruction of the left cornea followed. Death occurred on March 12, 1933. A necropsy was not allowed.

Case 2. L. C., a male child, 4 years of age, was admitted on May 15, 1934, because of an oral tumor which had been present for fifteen days. It had gradually enlarged and prevented opening of the mouth. The child had been well until October, 1933, when he complained of pain in the legs; he became progressively weaker and in December was unable to walk. Since April, 1934, the mother had noticed an increasing enlargement of the child's head.

The boy was emaciated, and his head was enlarged; he was mentally responsive but offered no cooperation (fig. 3). The sutures of the skull were widely separated and palpable. He was unable to lift his head from the pillow, and could not open his mouth more than 1 cm.

The exophthalmometer indicated a proptosis of approximately 6 mm. on either side. Vision was apparently normal, and ocular rotations were present but not accurately elicited because of lack of cooperation. The lids were normal but the lacrimal glands were enlarged on both sides. There was slight edema of the nerve heads. A deep, firm, irregular tumor mass occupied the region of the ascending ramus of the right mandible and both preauricular glands were enlarged. On the right side of the buccal cavity was a firm, tender mass, approximately 3 cm. in diameter; a similar smaller tumor was seen just lateral to the left lower molar. There was generalized lymphadenopathy and the upper abdomen was distended by many large fixed tumors and numerous small lymph nodes, but the spleen was not palpable. There was no fever. A marked secondary anemia was present; the urine was normal.

Roentgenograms showed wide separation of the sutures of the skull, with osteoporosis of the vault and the right mandible (fig. 4). There were destruction of the upper half of the left radius and ulna, and beginning changes of a similar nature in the right radius and ulna, and in the left humerus. Both femora showed destruction in the mid portions, with periosteal elevations and perpendicular striations of calcium extending outward along the lower third.

Biopsy was refused by the parents. On May 25, 1934, the child died and the tumor was removed from the inside of the mouth. The pathologic report*

* Pathologic description by Dr. C. F. Geschickter.

stated that the sections showed many small cells with dense nuclei and invisible or scanty cytoplasm. There were many typical rosettes (fig. 5). Histologically the tumor was a neuroblastoma of the Hutchinson type, in all probability originating in the adrenal.

Case 3. I. W., a female child, 5 years of age, was admitted on March 25, 1934, because of increasing pain in the right hip and the lower back over a period of 6 months. Since January the child had not been able to attend school, and for the past two weeks she had been bedridden. Physical examination on admission, except for a remittent fever and pallor, revealed no pathology. Roentgenograms of the skull showed separation of the sutures, as from increased intracranial pressure. There were periosteal changes in the long bones, with widening of the upper third of the femur and osteoporosis of the pelvis. The 7th and 11th dorsal vertebrae had collapsed. Examination of the blood revealed a secondary anemia.

On May 24, 1934, the girl was readmitted because of severe headache and acute pain in the arms and legs. The appetite had been poor and occasional attacks of vomiting had occurred. Examination revealed enlarged lymph nodes in the neck, axilla, and false pelvis; the spleen also was slightly enlarged. The veins of the forehead were congested, and the separated sutures and four large tumor masses in the scalp were palpable. Externally the eyes were normal but there were bilateral choked discs. Roentgenograms showed increased separation of the sutures of the skull and more advanced osteoporosis of the skull and pelvis. Beginning perpendicular striations of calcium extended outward from the periosteum of the parietal region of the skull. The blood picture was that of advanced secondary anemia.

A biopsy of a cervical lymph node was taken on May 31, 1934. The sections* showed a lymph node replaced by small cells with extremely dense nuclei (fig. 6). Many of these were carrot or wedge shaped and in numerous places typical rosettes were seen. The microscopic diagnosis was neuroblastoma, probably of adrenal origin.

The child's appetite remained poor, and vomiting continued. The condition gradually became worse, and opiates were required to control the pain in the arms and legs.

The child was taken home where she died on June 22, 1934. A necropsy was not allowed.

* Pathologic report by Dr. C. F. Geschickter.

Discussion

Although clinically a rather typical syndrome, neuroblastoma may present an indefinite pathologic picture, and the tumor has frequently been confused with myeloblastoma, lymphoma, chloroma and sarcoma. Microscopically the neoplasm is composed of groups of cells lying in a dense newly formed connective tissue. The nuclei of these cells are deeply blue stained and polymorphous, and are surrounded by a narrow rim of pale pink cytoplasm from which delicate fibrils arise (Geschickter). The cells may be clumped as a rosette in which they are arranged around a central mass of fibrils; in more differentiated forms of the tumor two groups of densely packed cells may be connected by a strand of the protoplasmic processes. This grouping has the appearance of an embryonic ganglion of the sympathetic nervous system (Wahl).

Irregular cells with large pale vesicular nuclei and a wide rim of pink cytoplasm, occurring in lesser numbers, have been described as embryonic ganglion cells by Wahl, Lehman, Scott and Oliver, and Lewis and Geschickter. In some areas there are pink staining cells which contain large dark-blue granules of disintegrated nuclear material.

Rosettes were found in approximately 30 percent of the cases reported by Lewis and Geschickter, and in about 50 percent of those presented by Wahl. Wright, Boyd[11], Lehman, and Verhoeff[12] also have commented upon their absence in neuroblastoma. Fibrils may not be present since, according to Wahl, the more embryonic or undifferentiated tumor cells do not produce them; or

they may not be recognized, as demonstrated by Wright, because they are very unstable and may rapidly disintegrate after death. Wolbach[13] thinks that the characteristic arrangements are often absent in metastases. For absolute pathologic diagnosis of biopsy tissue, rosettes or fibrils should be recognized, but in their absence in a tumor composed of the rather typical cells, neuroblastoma should be suspected.

The primary growth frequently arises from the adrenal medulla, but may develop in other tissue of the sympathetic nervous system. With growth of the tumor, metastases according to Frew and Boyd occur through the lymphatic system with early involvement of the regional lymph nodes, but eventually the more distant lymphoid tissue and the bone marrow become invaded. Geschickter states that the metastatic predilections for certain regions are dependent upon neither the cell type nor the relation of the primary tumor to the blood and lymph vessels, but upon the age of the patient. Hydrocephalus results from increased intracranial pressure due to metastases in the brain, dura, and skull. The bones of the orbit and the orbit itself become invaded and proptosis occurs.

Roentgenograms demonstrate hydrocephalus with wide separation of the cranial sutures. As the disease advances, an increasing enlargement of the skull with further widening of the sutures is observed. Localized areas of decreased density appear in the bones of the skull and pelvis as well as in the medullary portion of the long bones. In the advanced stage of the disease, characteristic whiskers or fringes appear as a result of formation of perpendicular lines of calcium extending outward from the bones.

The disease frequently begins with ecchymosis of the eyelids which is soon followed by proptosis. Frew noted that certain children first complained of pains in the extremities or joints, which when accompanied by fever led to an erroneous early diagnosis of acute rheumatic fever. He believed that the tumor in these cases arose from the left adrenal, but on the basis of a larger series of cases (162) Scott and Oliver concluded that this assumption was incorrect. Pain in the lower extremities was the first complaint in the second and third cases here presented.

The clinical pictures in the three cases are not dissimilar. In the third case no exophthalmos developed, but the hydrocephalus, secondary anemia, and cachexia were outstanding symptoms, while roentgenograms showed the characteristic bone changes. Lymphadenopathy occurred in all cases, and infiltration of the submaxillary gland was pronounced in case 1, while in case 2 the lacrimal glands were involved. In cases 2 and 3 abdominal tumors were palpable. In Hutchinson's 10 cases abdominal tumors were felt in only five; the absence of a palpable abdominal mass has been frequently observed since his original description. Only in case 2 was there no fever. Death occurred in all cases within nine months from the date of onset. Definite pathologic diagnosis of neuroblastoma was made from biopsy material in cases 2 and 3. In case 1, which was clinically most typical, rosettes or fibrils were not demonstrable in the microscopic specimens, but both Drs. Geschickter[14] and Wolbach considered the history typical of and the sections not inconsistent with neuroblastoma.

The ocular signs are dependent upon increased intracranial pressure and upon metastasis to the orbit. Choked disc accompanied the hydrocephalus in all cases, but orbital metastasis was definitely felt and pathologically demonstrated by biopsy in only one case. In the second case, perhaps there was an orbital mass that was not palpable, for the enlargement of the lacrimal glands was not sufficient to account for the degree of proptosis. Ecchymosis of the lids was present in case 1, and its association with orbital hemorrhage is suggested by the hemorrhagic nature of the tumor at operation.

The response of the first case to roentgen-ray therapy is interesting, especially since both the proptosis and the edema of the discs diminished greatly following the treatment, only to recur after a period of three months.

In the second case death intervened before response to therapy was expected, and in case 3 no treatment was given.

The diagnosis is not difficult in the typical case with ecchymosis of the lids, proptosis, hydrocephalus, anemia, and abdominal tumor. Scurvy causes ecchymosis of the lids and proptosis, but the other typical signs of this disease, together with the absence of hydrocephalus and the roentgenological evidence of neuroblastoma should facilitate diagnosis. In purpura hemorrhagica ecchymoses occur anywhere in the skin or mucous membrane and are spontaneous or related to trauma, and blood examination shows a diminished number of platelets. Acute leukemia is diagnosed by study of the blood smear, while the aleukemic forms of the disease frequently show enlargement of the spleen and lymph nodes but biopsy may be necessary to differentiate lymphoma, myeloblastoma, and lymphosarcoma. Ewing's tumor is associated with trauma, involves the long bones, and is not accompanied by hydrocephalus. Myeloma is rare in children, is accompanied by Bence Jones proteinuria, and roentgenograms show the typical punched-out type of bone lesions. Chloroma is usually accompanied by blood changes suggestive of leukemia, proptosis is unilateral, and the tumor is green in color.

The diagnosis in these cases was suggested by Doctor E. L. Rypins of the Department of Roentgenology. Dr. S. B. Wolbach and Dr. C. F. Geschickter reviewed the pathologic slides in these cases, and their descriptions and impressions have been incorporated in the paper.

Conclusions

1. Neuroblastoma is an occasional cause of proptosis and choked disc in children.

2. Three cases are presented in which the clinical picture is that of Hutchinson's type of neuroblastoma.

3. The histopathology of neuroblastoma is not always recognized because of the frequent absence of rosettes and fibrils.

4. The disease is rapidly fatal despite therapy.

References

[1] Hutchinson, R. On suprarenal sarcoma in children with metastases in the skull. Quat. Jour. Med., 1907, v. 1, pp. 33-38.
[2] Tileston, W., and Wolbach, S. B. Primary tumors of the adrenal gland in children. Amer. Jour. Med. Sci., 1908, v. 135, pp. 871-889.
[3] Frew, R. S. On carcinoma originating in the suprarenal medulla in children. Quat. Jour. Med., 1911, v. 4, pp. 123-140.
[4] Wright, J. H. Neurocytoma or neuroblastoma. Jour. Exp. Med., 1910, v. 12, p. 556.
[5] Wahl, H. R. Neuroblastoma. Jour. Med. Res., 1914, v. 30, pp. 205-260.
[6] Lehman, E. P. Neuroblastoma. Jour. Med. Res., 1917, v. 36, pp. 309-326.
[7] Geschickter, C. F. Tumors of the suprarenal gland. Arch. of Path., 1933, v. 15, pp. 755-788.
[8] Pepper, W. A study of congenital sarcoma of the liver and suprarenal. Amer. Jour. Med. Sci., 1901, v. 121, p. 287.
[9] Scott, E., Oliver, M. G., and Oliver, M. H. Sympathetic tumors of the adrenal medulla. Amer. Jour. Cancer, 1933, v. 17, pp. 396-433.
[10] Lewis, D., and Geschickter, C. F. Tumors of the sympathetic nervous system. Arch. of Surg., 1934, v. 28, pp. 16-58.
[11] Boyd, Wm. Textbook of pathology. Ed. 2. Philadelphia, Lea and Febiger, 1934, p. 755.
[12] Verhoeff, F. Discussion of Burch, F. Oribtal metastases from malignant tumors of the suprarenal gland. Arch. of Ophth., 1932, v. 7, p. 433.
[13] Wolbach, C. F. Personal communication.
[14] Geschickter, S. B. Personal communication.

STRABISMUS IN CHILDREN CORRECTED BY REFRACTION ALONE

GEORGE P. GUIBOR, M.D.
CHICAGO

The results of correcting the refractive errors in 185 cases of constant concomitant strabismus are presented. Squint had existed at least one year previous to the wearing of glasses. No atropinization nor occlusion nor orthoptic training was attempted. A high degree of squint, amblyopia, severe defects in motility and in fusion were the greatest obstacles to recovery. The patients under four years of age recovered more quickly than those over four. The accommodative type of squint recovered more readily than any other type. Of the 185 cases, 63.4 percent were unimproved, 13 percent were improved, and 23.6 had no squint with glasses. From the Department of Ophthalmology, Children's Memorial Hospital, Chicago, Illinois. Presented before the Chicago Opthalmological Society, February 18, 1935.

Recovery from nonparalytic intermittent squint is common, especially when the refractive error is corrected by the use of glasses. Amblyopia is not present, nor is fusion ability suppressed. On the other hand, squint of more permanent or confirmed type, which has existed for a year or more, does not disappear so quickly even after glasses are worn, and when fusion training is attempted. It seemed desirable, therefore, to study a group of confirmed squinters who had their refractive errors corrected but who had no atropinization, no occlusion of the fixing eye, and no orthoptic training. A number of such studies have been reported.

Maxwell[1] discussed improvements through the use of glasses; he secured 30 percent of "cures" in patients 5 years of age, and 20 percent in those 8 years of age.

Barrie[2] discussed a series of thirty-three cases of squint that had been under his observation several years; 36.30 percent of these were "cured" by glasses.

Griffiths[3] believed that flat fusion is serviceable in maintaining binocular vision when stereoscopic depth perception is absent or suppressed. He believed that suppression is a normal condition. This may explain why certain amblyopic squinters are unable to fuse stereoscopic pictures, yet the squint disappears after a time when glasses are worn. This author also reported a series of one hundred squinters. Fifty-one were amblyopic, fifteen alternating. Of these cases of alternating squint there were only four with no binocular vision.

Maddox[4] discussed false fixation as did also Miss Pugh[5]. The former remarked that results with orthoptic training are easily achieved in patients whose eyes are straight with glasses but who squint without them. I have a few cases with this abnormality, one of which I am reporting in this article. Miss Pugh reported that 42 percent of patients with squint have false projection even with correction of the refractive error.

Peter[6] believed that glasses will produce a maximal recovery from squint in one month's time. He discussed the value of glasses, and believed that the angle of squint was not lessened when (1) the deviation was too wide, (2) when the internal rectus was contracted and the externus relaxed, (3) when amblyopia was present, and (4) when a defect in fusion faculty was present.

I secured the records of confirmed squinters entering the Children's Memorial Hospital previous to September, 1932. This was necessary because the Orthoptic Clinic was started in September of 1932 at this institution and all patients since this date have been treated with atropine and occlusion.

A total of 205 records was obtained and details recorded. All patients who had had atropinization or occlusion of the fixing eye or who had had fusion training were excluded. No patient who had been operated upon, no case of intermittent squint, and none of periodic squint were included. Only those that

Table 1

DIAGNOSIS OF SQUINT IN REFRACTION-TESTED GROUP (185) OF CASES

Age group Years	Monocular Convergent Squint Number of Cases	Alternating Convergent Squint Number of Cases	Monocular Divergent Squint Number of Cases	Alternating Divergent Squint Number of Cases
2 to 4	56	7	0	0
5 to 7	70	14	1	0
8 to 12	30	5	0	2
Total	156	26	1	2

Table 2

RECOVERY IN AGE GROUPS (185)

Age Groups Years	Squint Unimproved		Squint Improved		Squint Absent with Glasses	
	No. of Cases	Percent	No. of Cases	Percent	No. of Cases	Percent
2 to 4	34	18.378	9	4.75	19	10.27
5 to 7	56	24.86	13	7.	16	8.64
8 to 12	27	14.595	2	1.67	9	4.75
Totals	117	63.43+	24	13.	44	23.6

showed no deviation for far and near were considered as recovered. Those with a deviation for near were considered improved but not recovered. Most of these original 205 patients who entered the ophthalmic clinic of the Children's Memorial Hospital between 1928 and 1932 had been under observation a year or more after glasses were worn. The maximum effect produced by a correction of the refractive error had therefore occurred and been recorded by one or more observers.

Twenty of these 205 cases were discarded because of the insufficient data or because the squint was intermittent. This left 185 cases upon which to base this report.

The 46 patients who were recorded as having recovered were asked to return to the Orthoptic Clinic to record their present status. Only thirty of these cases were examined and only two were transferred from the recovered group to the improved group because it was found that a complete recovery from squint had not occurred.

The examination of these recovered cases included the determination of: (1) Visual acuity, with and without glasses; (2) fixing power; (3) motility, both monocular and binocular; (4) angle gamma; (5) angle of squint, both with and without glasses for far and near; (6) fusion ability.

Observations

Of the 185 cases (see table 1), 156 were of monocular and 26 of alternating convergent squint. One case of monocular divergent and two of alternating divergent squint were found. Expressed in percentages, 99.13 percent were cases of convergent squint, 83.13 percent of these being of the monocular and 14 percent of the alternating convergent type; 1.67 percent were cases of divergent squint, of which .54 percent were of the monocular and 1.13 percent of the alternating type.

The ages of the patients ranged from two to thirteen years (table 1), 78.9 percent being between two and seven years of age and 21.1 percent over seven. It is interesting to note that the percentage of squint in the 2-to-4-year group was 34, in the 5-to-7-year group 40.54, and in the 8-to-12-year group 20. These percentages corroborate the findings of others; namely, that squint appears most often between the ages of five and seven years. It is also interesting to note that divergent squint is not common in young children (1.67 percent) and appears later in life (8-to-12 group) than does convergent squint.

Results procured by correcting refractive error

In table 2 the results secured by correcting the refractive error with glasses

alone and without the use of atropinization or occlusion of the fixing eye, fusion training, or surgery are recorded. It should be remembered that 30 of the 44 cases recorded as recovered have been examined within the last sixty days and that the accuracy of the records was checked by the author. The other groups in this report were not asked to appear so that some of them may have improved or recovered without his knowledge. Also that only those squints which have no abnormal deviation for far or near were recorded as recovered. The numbers of cases are divided into age groups as well as into groups that are unimproved, improved, and recovered cosmetically with glasses. Of these three series, the unimproved groups (117 cases) outnumbered the improved almost 5 to 1, and outnumbered the recovered group almost 3 to 1. Translated into percentages, 63.43 percent of patients were unimproved, 13 percent showed an improvement of more than 10 degrees of squint, and 23.6 percent had no squint with glasses on. When glasses were removed, however, only nine patients disclosed no squint (0.4 percent). Of those unimproved, 18.37 percent were between two and four years of age, 24.86 percent between five and seven, and 14.59 percent between eight and twelve. Of the improved group 4.75 percent were between two and four years of age, 7 percent between five and seven years, and 1.67 percent between eight and twelve. The percentage of improvement in these groups appears to have some relationship to their ages. In the recovered group, however, 10.27 percent were between two and four years of age, 8.64 percent between five and seven years, and only 4.75 percent between eight and twelve. These figures disclose two facts: (1) that correcting the refractive error alone fails to relieve confirmed squint in over 63 percent of the cases and produces a recovery in only 23.6 percent, and (2) that when recovery occurs it is more pronounced in the younger-age groups, i.e., in children between two and four years of age, and that two cases in the two-to-four group recover to every one between eight and twelve years of age. In comparing these percentages of recoveries with those of two other groups of squinters which I have had under observation for two years, previously reported, we can obtain a fair idea as to the relative efficiency of occlusion and atropinization and orthoptic exercises besides the results secured by correcting the refractive errors alone.

Table 3

THE RELATIVE EFFICIENCY OF GLASSES ALONE, OF GLASSES, ATROPINE, AND OCCLUSION, AND OF ORTHOPTIC EXERCISES TO SECURE RECOVERY FROM SQUINT

Glasses Alone	Glasses Atropinization, and Occlusion	Orthoptic Exercises
Percent	Percent	Percent
23.6	25 to 30	50

In the two previous reports[8, 9] it was demonstrated that atropinization and occlusion of the fixing eye will produce a recovery from squint in 25 to 30 percent of the cases, and that orthoptic exercises will produce recovery in an additional 50 percent.

Lack of recovery from squint is said to be due to a wide angle of squint, to amblyopia, to false projection, and to a poorly developed fusion faculty.

In subjective tests with children the data are always unreliable until such tests are repeated a number of times. Visual-acuity tests and tests for false projection especially are open to criticism; tests for stereopsis are less so. For example, a child when fatigued or irritable will show such poor cooperation in determining visual acuity that 20/50 will be recorded. This same child when rested will read down to the 20/20 line in the illiterate chart. If one were occluding the fixing eye credit would be given to occlusion for the improvement in vision, whereas the improvement would be due to a more prolonged effort on the part of the examiner to obtain the vision under more cooperation from the child. Records are available of a number of cases in this present report in which there was a visual acuity of 20/200 for several weeks following the prescribing of glasses, which improved to 20/20 over a year's time. In

some of these cases records of poor vision were probably due to lack of cooperation at the time the vision was taken and some to a suppression type of amblyopia which seems to disappear in younger patients many times without occlusion or atropinization of the fixating eye. On the other hand, a second type of amblyopia exists in which visual acuity is 5/200 to 20/200 and which will rarely show an improvement even with occlusion, atropinization, and fusion training. A comparison of the number of amblyopic cases in the groups of squints are shown in table 4.

Table 4

RECORDED IMPROVEMENT IN VISUAL ACUITY IN RELATION TO IMPROVEMENT IN THE ANGLE OF SQUINT (62 CASES)

	Squint Unimproved	Squint Improved	Squint Recovered
Number of Cases	37	5	20
Vision Improved 2 or more Snellen Lines	13	4	18

It can be seen by examining table 4 that there were 37 cases of poor vision in the unimproved group of 117; 5 in the improved group of 24, and 20 in the recovered group of 44. Thirteen of these 37 cases of poor vision in the unimproved group, 4 of the 5 cases in the improved group, and 18 of the 20 cases in the recovered group showed an improvement in vision of two or more lines in the Snellen chart. Thus, unimprovement in visual acuity accounts for many failures in the correction of squint.

The degree of squint: In most cases of squint the greater the degree of abnormality the less the opportunity for recovery.

Table 5

RESULTS SECURED BY GLASSES IN HIGH AND LOW DEGREE OF SQUINT

Degree of Squint	No. of Cases	Percentage Corrected
15 degrees or less	76	44.73
Over 15 degrees	109	.91

In table 5 the fact is emphasized that in 76 cases of squint of 15 degrees or less and in 109 cases of over 15 degrees, glasses produced an absence of squint in 44.73 percent in those with 15 degrees or less but in only .91 percent in those with more than 15 degrees. If orthoptic training is used, 84.1 percent will recover from squints of 15 degrees or less, and 15.9 percent from squint of over 15 degrees, according to the findings in my previous reports.

False projection

This is the most unreliable subjective test in my hands that I use. No detailed tests for this phenomenon have been made in this group so no data can be given. I present a case, however, to show this condition: D.J., aged 12 years, with a right convergent squint of 20 percent which had been present since he was two years of age, was seen by me on January 15, 1933. His unaided visual acuity was O.D. 20/100; O.S. 20/50. Vision with correction was: O.D. + 4.50 D.sph. $\bigcirc\!\!\!\!\!\!=$ + 1.75 D. cyl. axis 55° = 20/200. O.S. + 3.25 D.sph. $\bigcirc\!\!\!\!\!\!=$ + 1.00 D. cyl. axis 120° = 20/30. These glasses had been worn for three years. No squint was present for far or near with glasses. In the stereoscope, however, 20 degrees of right convergent squint appeared. Some fusion and stereopsis were present. This patient was also seen by Dr. Gamble and Dr. Vorisek. Cover tests disclosed no deviation for far or near. Macular fixation was present except when stereoscopic tests were made in the stereoscope.

Defects in the fusion faculty

Tests for stereoscopic ability are more reliable in my hands than are those for visual acuity and false projection. If fusion tests are repeated quite frequently with the amblyoscope and stereoscope, using special test charts and observing the eyes and their movements during fusion, reliable, accurate data can be secured.

The following findings are presented: 50 percent of the recovered cases in this series possessed stereoscopic ability, 17 percent had plane vision, 16 percent had binocular vision but no fusion

while 17 percent had monocular vision. The question of why this 17 percent with monocular vision did not squint, is an important one. It has been suggested that either a severe diplopia occurs when a deviation appeared or a muscle sense maintained a parallelism of the visual axis.

Alternating squint

The idea that alternating convergent squint is a separate entity is gradually being changed. Several reasons for the changing ideas are emphasized in this group. First, monocular squint frequently becomes alternating. Eight cases of monocular convergent squint in this report became alternating and so were placed in the unimproved group of squints. Secondly, alternating squint does recover with glasses (see table 6).

Table 6

RESULTS IN ALTERNATING SQUINT (26 CASES)

Unimproved	Improved	Recovered
19	2	5

In table 6, in a group of 26 cases of alternating squint without a previous history of monocular squint, five patients had no squint after glasses were worn for six months. Thirdly, many children with alternating squint can fuse and do possess stereoscopic ability. Of these patients with alternating squint three could fuse with depth perception and two had second-degree fusion.

Before giving my conclusions I wish to report several cases to show the types of squint that recover from atropine, occlusion, orthoptic training, and in this series by refraction without any other procedure.

Case reports—Accommodative type

Case 1. M. B., aged 4 years, was brought in with a left convergent squint of 10 degrees which had been present since birth. He was seen first at the Children's Memorial Hospital when two years of age and wearing a correction: O.S. +1.25 D. sph.

Under atropine retinoscopy: O.D. +4.00 D. sph. ⌯ +0.25 D. cyl. axis 105°; O.S. +4.00 D. sph. ⌯ +0.50 D. cyl. axis 120° was found.

The correction glass was: O.D. +2.50 D. sph. ⌯ + 0.25 D. cyl. axis 105°; O.S. +2.50 D. sph. ⌯ +0.50 D. cyl. axis 120°.

October 26, 1932 (aged 4) the vision was: O.U. 20/20, with glasses 20/20.

On December 15, 1932, no squint was present for far or near.

On January 21, 1935, no squint was present for far or near with or without glasses. The motility was excellent. An apparent divergent squint of 12 degrees was present. This was due to a wide angle gamma of 6 degrees in each eye. A weak stereoscopic ability was present. Cover test was negative for far and near. Diagnosis: Recovered left convergent squint with stereopsis present—accommodative type.

Case 2. I. N. W., complained of a left convergent squint of 20 degrees which had begun when he was four years of age. He was seen first at the Children's Memorial Hospital at the age of five years, March, 1930.

Under atropine retinoscopy: O.D. +6.50 D. sph. ⌯ +2.50 D. cyl. axis 105°; O.S. +6.50 D. sph. ⌯ +2.50 D. cyl. axis 80°.

The corrective glass was: O.D. +4.00 D. sph. ⌯ +2.00 D. cyl. axis 105°; O.S. +4.00 D. sph. ⌯ +2.00 D. cyl. axis 80°.

The vision was: O.D. 20/100, with glasses 20/20 in 2 months; O.S. 20/20, with glasses 20/20.

On August 15, 1932, a left convergent squint of 30 degrees without glasses and a 5-degree with glasses existed. In January, 1933, an atropine retinoscopy was recorded: O.D. +6.00 D. sph. ⌯ +2.75 D. cyl. axis 95°; O.S. +6.50 D. sph. ⌯ +2.25 D. cyl. axis 75°.

The second corrective glass of O.D. +4.50 D. sph. ⌯ +2.75 D. cyl. axis 95°; O.S. +5.00 D. sph. ⌯ +2.25 D. cyl. axis 75° was given.

On April 30, 1934, and January 7, 1935, no squint was present for far and less than 5 degrees of left convergent squint was present for near with glasses on.

Motility: A slight defect on abduc-

tion (1 mm. sclera at temporal limbus) existed.

Fusion and stereopsis were excellent. Fusion amplitude was of poor quality.

Diagnosis: Recovered accommodative muscle-defect type of squint. Note: If hypermetropia, good vision, and good fusion are present, then a muscle weakness does not prevent recovery.

Case 3. F. T., aged 6 years, complained of a left convergent squint of 10 degrees which had been present since birth. He was seen first at the Children's Memorial Hospital, June, 1931, at the age of seven years.

The vision was: O.D. 20/20; O.S. 20/40.

Under an atropine retinoscopy: O.D. +3.50 D. sph. ⊂⊃ +0.25 D. cyl. axis 105°; O.S. +5.50 D. sph. ⊂⊃ +0.50 D. cyl. axis 75°.

The corrective glass: O.D. +2.50 D. sph. ⊂⊃ +0.25 D. cyl. axis 105°; O.S. +4.00 D. sph. ⊂⊃ +0.50 D. cyl. axis 75° was secured.

January 9, 1932, vision was: O.D. 20/20, with glasses 20/20; O.S. 20/50, with glasses 20/20.

When seen January 21, 1934, no squint was present with or without glasses for far or near.

Motility: a slight overaction of 3 prism diopters of the left superior rectus and a slight underaction of 3 prism diopters of the right inferior oblique were found.

Fusion: A pseudobinocularism was present, in the form of rapid alternating monocular vision.

Diagnosis: A cosmetically recovered squint, amblyopic, accommodative vertical-muscle defect type, some muscular instability present; absent stereopsis.

Conclusions

1. A report is made of 185 patients with confirmed nonparalytic squint, for whom only glasses were prescribed and who did not have the benefit of occlusion, atropinization, nor fusion training. Of these patients 63.43 percent were unimproved, 13 percent were improved and 23.6 percent had no squint with glasses (nine patients or 0.4 percent had no squint when glasses were removed).

2. A high degree of squint and amblyopia have the greatest influence in retarding recovery from squint.

3. Out of 26 patients, 5 with alternating squint recovered with the use of glasses; of these, three could fuse with depth effect, and two had poor fusion of flat objects.

4. Patients in the younger groups (2 to 4 years) recover more easily and in greater numbers than do those in the older-age groups.

5. Patients with the accommodative type of squint recover most readily by correction of the refractive errors.

These records were made available through the courtesy of Dr. Richard Gamble. The findings in the groups treated by atropine and occlusion and by orthoptic training were obtained with the aid of a grant from the Knapp testimonial fund and a grant from the American Academy of Ophthalmology and Otolaryngology.

30 N. Michigan Avenue.

References

[1] Maxwell, E. P. Amer. Jour. Ophth., 1919, v. 3, August, p. 346.
[2] Barrie, S. Trans. Ophth. Soc. U. Kingdom, 1932, v. 52, p. 363.
[3] Griffiths, A. Trans. Ophth. Soc. U. Kingdom, 1931, v. 51, p. 296.
[4] Maddox, E. E. Trans. Ophth. Soc. U. Kingdom, 1931, v. 51, p. 296.
[5] Pugh, M. A. Amer. Jour. Ophth., 1931, v. 18, January, p. 56.
[6] Peter, L. L. Symposium on the treatment of nonparalytic squint. Trans. Ophth. Soc. U. Kingdom, 1932, v. 52, p. 328; also Amer. Jour. Ophth., 1933, v. 16, June, p. 482.
[7] Guibor, G. P. Arch. of Ophth. 1934, v. 11, March, p. 433.
[8] ———. Amer. Jour. Ophth., 1934, v. 17, September, p. 834.

BACILLUS PYOCYANEUS INFECTION OF THE EYE

Report of two cases

W. W. LANOU, M.D.
IOWA CITY, IOWA

Two cases of corneal injury followed by an ulcerative keratitis and panophthalmitis are reported. Bacillus pyocyaneus was isolated in pure culture. Its biological characteristics and identification are discussed. Attention is called to the fulminating nature of such infections in the eye. From the Department of Ophthalmology, College of Medicine, State University of Iowa.

Bacillus pyocyaneus infection of the eye is rare. Sattler[1] reported the first case in 1891, and since then approximately 25 cases, including a group of 7 industrial cases by Garretson and Cosgrove[2], have been recorded. The infection is usually a virulent one and, as a rule, the clinical course is extremely rapid and terminates in loss of the globe; however, an occasional case assumes a more chronic form and responds favorably to treatment. This variability in virulence of the organism has been well demonstrated experimentally by different workers[3, 4, 5]. The two cases herewith reported afford further proof of the extreme virulence of Bacillus pyocyaneus infection in the eye.

Report of Cases

Case 1. J. P., a farmer, aged 45 years, entered the hospital with a history of having been struck in the eye with a piece of gravel, four days previously. The foreign body had been removed immediately by a local physician but on the following day the eye had become red and congested, painful, and sensitive to light. Treatment had been of no avail. On admission to the hospital, the vision was found to have been reduced to bare light perception. The eye was extremely painful and tender. The lids were red and swollen, the ocular movements painful and restricted, and the conjunctiva was congested and chemotic, while the entire cornea was deeply ulcerated, a groove extending around the margin where the ulcer had apparently penetrated more deeply into the posterior layers. No view of the underlying structures was obtainable.

A diagnosis of early panophthalmitis was made and on the sixth day after injury the contents of the globe were eviscerated. There was pus in the anterior chamber but grossly the vitreous was clear.

Case 2. J. R., a railway engineer, aged 47 years, had been struck in the eye by a cinder one week prior to admission. Three days later the eye had become irritated and the embedded foreign body had been removed from the cornea. No bandage had been applied. The next day a scratching sensation had developed; the eye had become painful. The patient was informed that he had a corneal ulcer. Despite treatment the condition progressed and the following day he was admitted to the hospital. The vision was reduced to perception of light; pain, photophobia, and lacrimation were present; there was pronounced blepharospasm and the lids were edematous; the conjunctiva was injected and somewhat chemotic; and over the nasal side of the cornea was a deep crescentic ulcer. The iris was not visible.

Despite cauterization with phenol of the base and edges of the ulcer on the day of admission, instillations of scopolamine, one-fifth percent three times daily, dionin, 5 percent twice daily, hot packs for 15 minutes every two hours, and graded intravenous typhoid injections on the first, third, and fifth days, the ulcer extended rapidly over almost the entire cornea and within a week the anterior layers sloughed away. An evisceration was made just 2 weeks after the injury. The aqueous was purulent but grossly the vitreous was clear.

Bacteriology: Culturally identical organisms were recovered directly from the ulcerated cornea in each case, and also from the anterior chamber in the first case. No growth was obtained from the anterior chamber in the second case. Morphologically the organism was a short, slender, motile, gram-negative rod. It grew readily on all forms of media. The colony was flat, had dentate borders, and spread rapidly. On plain agar, in broth, and in leptospira medium, a bluish-green pigment was formed which diffused throughout the medium. A positive reaction was obtained from an aqueous solution of this pigment with the chloroform-hydrochloric-acid test for pyocyanin. Blood agar was hemolized. Blood serum and gelatin were liquefied. Gas was not formed with dextrose, xylose, saccrose, maltose, lactose, dulcite, mannite, nor levulose, and, except for a slight acid reaction, visible after 48 hours in dextrose and xylose, none of these sugars was fermented. In litmus milk the proteins were precipitated and digested; the reaction was acid at first but after 7 or 8 days became alkaline. Conclusion: Bacillus pyocyaneus (Pseudomonas aeruginosa[6]).

Animal pathogenicity

Injections of a saline suspension from a 24-hour plain agar culture were made directly into the stroma of the cornea and into the anterior chamber of rabbits. The injections resulted in rapid fulminating reactions. At the end of 16 hours the lids were red and swollen, there was a severe conjunctivitis with profuse discharge, and the entire cornea was ulcerated and sloughed away. After a period of ten days the reaction gradually subsided but the eye was hopelessly destroyed. The eyes were enucleated and the organisms were recovered in pure culture from the vitreous.

Comment

Bacillus pyocyaneus infection of the eye usually manifests itself in the form of an ulcerative keratitis which spreads rapidly to the surrounding tissue and results in panophthalmitis. Outstanding exceptions are a case of dacryocystitis reported by Tersen[7], one of conjunctivitis by Derby[8], and one of punctate keratitis by Herbert[9]. The course is rapid and the reaction, which is severe, is at least partly attributable to a toxin which diffuses through the tissues. Most cases give a history of corneal injury, and experimental inoculation of animals has shown that infection is more easily produced if preceded by corneal abrasions. Diagnosis is dependent upon the recovery and identification of the Bacillus pyocyaneus. In our cases, while there was no difficulty in culturing the organism nor in demonstrating it in smears, positive identification was not made immediately on account of lack of familiarity with the organism. The presence of a short slender gram-negative rod in smears, luxuriant growth on plain agar, and the production of a diffuse bluish-green pigment are sufficient evidence to justify a diagnosis. Many forms of treatment have been tried but the results have been variable; it is impossible to determine the value of such therapeutic measures, especially when one considers the great difference in virulence of the organism. Antitoxin and bacteriolysin, formed after animal inoculation, confer a passive immunity and this offers a possible therapeutic measure of value which as yet has not been tried clinically[3].

Summary

1. Two cases of corneal injury followed by a fulminating corneal ulcer and signs of early panophthalmitis are reported.

2. Bacillus pyocyaneus was identified as the etiologic organism and its pathogenicity for rabbit eyes demonstrated.

References

[1] Sattler, H. Ophth. Gesellsch., Heidelberg, 1891, v. 21, p. 201; quoted from ref. 2.
[2] Garretson, W. T., and Cosgrove, K. W. Jour. Amer. Med. Assoc., 1927, v. 88, March, p. 700.
[3] Jackson, Edna, and Hartman, F. W. Jour. Lab. and Clinic Med., 1927, v. 12, February, p. 442.

[4] McNab, Angus. Ophth. Rev., 1904, v. 23, p. 65.
[5] Safar, Karl. Ztschr. f. Augenh., 1927, v. 61, January, p. 25.
[6] Bergey, D. H. Manual of determinative bacteriology. Baltimore, Williams and Wilkins Co., 1934, p. 174.
[7] Tersen. Citation from Axenfeld, T. Bacteriology of the eye. London, Baillière, Tindall and Cox, 1908, p. 311.
[8] Derby, G. S. Amer. Jour. Ophth., 1905, v. 22, p. 1.
[9] Herbert, Major I. M. S. Ophth. Rev., 1901, v. 20, p. 339.

TRACHOMA AS AN ENDEMIC DISEASE IN EGYPT

FARID MASSOUD, M.D.
CAIRO, EGYPT

This is a study of 4000 patients in regard to incidence and course of trachoma, showing that it is acquired in infancy, and that personal hygiene and diet added to local irritation are factors in its causation. For prophylaxis, care of the eyes of babies from birth in local antitrachoma dispensaries is necessary. Read at the annual meeting of the Ophthalmological Society of Egypt, March 22, 1935.

About two-and-one-half years ago, I read a paper at a meeting of the Egyptian Medical Association on the general or constitutional element in the pathology of trachoma. The following were the conclusions mentioned at that time:

1. At the bottom of every case of trachoma there is an excess of lymphatic tissue in the body due primarily to the mode of living.

2. In the conjunctiva, lymphatic tissue comes to be particularly in excess owing to the various sources of irritation.

3. These two factors favor the production of a pretrachomatous state that is most suitable for the development of the trachoma virus.

4. The recognized stages of trachoma are due to microbic activity superimposed on the previously mentioned condition of the tissues.

From these conclusions a practical application was pointed out; namely, that in the treatment of trachoma attention to the mode of living in diet as well as in excretion was just as important as the therapy of the local condition.

It was with a view to studying further the question of trachoma as connected especially with its incidence and prophylaxis that this study was undertaken during the past two-and-one-half years. The patients observed attended private dispensaries and were generally in better economic circumstances than the ordinary fellaheen of the villages. They were mostly inhabitants of Cairo and in addition to the great majority who were Egyptians, included also representatives of such other nationalities as Armenians, Jews, Syrians, a few Greeks, and a few Italians. Their number amounted to 4,000, three fourths of whom were infants and young children. It was possible to watch some of these infants from birth for prophylaxis, and it has been possible to follow up many patients.

Besides young infants, adults came because of a feeling of habitual discomfort in the lids which, they had found by experience, was relieved by the application of silver nitrate from time to time. These presented the usual quiet stages of trachomatous infiltration.

The greatest majority of the patients observed, however, presented on their first visit the usual picture of acute or subacute ophthalmias or mixed infection, following the treatment of which a condition of underlying trachoma became apparent.

The usual treatment (local) was a light painting with silver nitrate combined with an application of yellow oxide of mercury, 1 percent.

Special attention was directed, however, to the patients' general condition. A constant routine was advised simplified to a purge at the beginning of treatment followed by measures to keep

the bowels open and the prescription of a light diet for some time. The patients were instructed in personal hygiene, and a daily bath of the whole body was insisted on whenever possible.

Observations

The observation of these patients presented several points of interest; only a very brief note of what concerns us here can be mentioned now.

I. The relation between trachoma and other ophthalmias. (1) There were many cases of infants who developed a trachomatous condition without ever having had signs of an ophthalmia. (2) An eye in which trachoma had been established was found to be more predisposed to attacks of ophthalmia than a healthy eye. (3) In the apparently healthy eyes of infants who developed an ophthalmia, there seemed to be constantly a previous preparation of the conjunctiva for the activity of the particular virus in question.

II. The relation of trachoma to age. (1) It was not easy to make a positive diagnosis of trachoma in infants under the age of three months. (2) After the age of 6 months it was quite rare to find a case of ophthalmia that was not also accompanied by trachoma.

III. The relation between the condition of the conjunctiva and the cleanliness of the skin of the body or lack of it. (1) In all cases of ophthalmia it was possible to trace a gross neglect of personal hygiene which had been going on for some time. (2) Rapid improvement in the condition of the conjunctiva occurred whenever daily bathing of the whole body was practiced as a routine measure. This applied to both adults and infants, in whom it was particularly noticeable.

IV. The relation between the condition of the conjunctiva and the diet. (1) Excess of diet on the whole was aggravating to the condition of the conjunctiva whether in infants who were irregularly fed or in young children and grown ups who were taking more food than was good for them. A light diet was always more favorable for promoting improvement. (2) Purging and free bowel movements influenced the conjunctiva more favorably than otherwise.

Discussion

In considering the problem of trachoma as an endemic disease, an important fact comes at once into evidence in the great number of infants and young children who are affected by the disease. This fact was noted as early as 1901 by Morax[1] and then in 1911 by Peretz and Meyerhoff[2] and then again lately by Wilson[3]. If we are to conclude anything from this fact, which is an every-day experience, it is this, that cases of trachoma seen in adult life owe their origin to a previous infection earlier in life, or in other words that trachoma as an endemic disease is an affection of early childhood or infancy (Pagès[4]).

Coming to analyse the factors that seem responsible for the acquiring of trachoma on a large scale, we cannot possibly overlook the soil or medium on which the trachoma virus is implanted. That this soil is not always favorable to its growth is already known (MacCallan[4a]), and the question already has been asked (Crisp[5]) why in a country so infested with trachoma, infection which has been proved beyond doubt is not a matter of daily experience? The answer has also been mentioned; namely, that there is often a close association between viruses and the tissue or organ in which they multiply in the living animal (Perdrau[6]).

Thus the recognition that a favorable soil is required for the development of the trachoma virus is steadily gaining ground; it is mentioned by Cuénod and Nataf[7] and other observers (Uudelt[8]) besides those of the Italian school (Cattaneo[9]).

Now the factors responsible for the production of a favorable soil for the trachoma virus are first, external, and include the various sources of irritation affecting the conjunctiva.

This is probably the idea of Mayou[10] and others (Puscariu[11]) in stating that trachoma does not supervene on a normal conjunctiva.

Much more important, however, are the internal or constitutional factors which De Grosz[12] and others—Yud-

kin[13]—admit as having an undoubted influence on the course and complications of the disease.

The factors, then, influencing the constitution are first, personal hygiene, and second, diet.

Personal hygiene. The condition of babies affected with trachoma is well known; they are invariably lacking in this matter. As to the adults, Meyerhoff[14] states that the improved conditions that have prevailed in the British Army of Occupation in Egypt as regards ophthalmia, throughout a stay of over half a century, are due to the personal cleanliness of the troops and the high standard of their education in hygiene.

It must be clearly understood, however, that personal hygiene, though much concerned with the removal of external dirt is yet more concerned with internal dirt or waste matter in the tissues, which manifests itself in all the mucous membranes including the conjunctiva and constitutes naturally a most favorable soil for the growth of microorganisms.

Diet. The second factor is already known to exert a certain influence on the conjunctiva; chronic or recurrent conjunctivitis has been known to arise from an excessive diet of carbohydrates (Pratt[15] and Stobie[16]).

In Egypt there are well-known faults of diet, chief among which is the excessive eating among the babies of the poorer classes.

Very suggestive is the fact reported by Wilson[17] that a marasmic child seen in a village near Cairo proved to be the only child over one year of age in that village who did not have trachoma.

Experimentally it was noted (Hetler and James[18]) that there was less infection in malnourished monkeys than in those adequately nourished.

Incidentally, it is of interest to mention the case recorded by Bywater and Holmes[19] of severe trachoma and pannus which did not improve with any treatment, until the patient was operated on for appendicitis when, without treatment, her condition was found to be quite normal some weeks after. The record goes on to say that with the resumption of her ordinary life the condition of trachoma again reappeared.

There is no trachoma in the Hejaz and Mecca where there is no farming and the people are half starved most of the year; this notwithstanding the fact that there is constant contact with pilgrims from trachoma-infested countries.

In the immediate neighborhood (Nejd) on the other hand, where there are farms and a plentiful supply of food, all the people have trachoma (Galal[20]).

Prophylaxis

One of the best examples mentioned in connection with work against trachoma is the system of the Egyptian Ophthalmic Hospitals. It is almost universally quoted as a model of efficiency in the treatment of trachoma patients. This fact alone is a stimulus to the authorities in building up a system of prophylaxis worthy of this world-wide fame.

The idea now prevails, once expressed by Bishop Harman[21], that trachoma can be controlled and that its control is a practical proposition. So much has been already achieved in other countries: In the United States of America entire localities have been cleared of trachoma since it was first declared a dangerous contagion, in 1907. In Japan and other places there is obligatory inspection of the eyes. In Tunis, Algeria, and Palestine antitrachoma organizations have been established with special attention directed to the babies and mothers.

In Egypt, prophylaxis should meet three requirements: (1) The infants, in whom the source of the disease lies, must be reached. (2) The poor laboring class must be treated without interference in their ordinary work or occupation. (3) Funds must be procured for generalizing the plan.

A Practical Scheme

In January 1933, an experiment along this line was begun and is still going on. An ophthalmic welfare center was started in a poor and crowded quarter

in Cairo, and later on another center was added in a well-to-do and healthy locality, both being conducted for cases of trachoma and ophthalmia only.

Mothers are urged to bring their infants for the care of the eyes.

Certain persons in the locality who are interested in this work form a sort of committee to help in spreading the teaching of personal hygiene.

The results of this work, in view of the difficulties met with, are still encouraging to its further continuance.

A similar system was described in detail by Parrot[22] of Algeria in 1921. He advised the spreading of these welfare centers or antitrachoma dispensaries or clinic rooms, over a locality in such numbers as to make it possible to cope with all of its population.

These centers treat the patients in the family, so to speak, without inconvenience to them, study the spread of the disease, instruct the patients, and send the bad cases to hospitals.

Reduced to the strict minimum in everything, their budget being autonomous, they can be operated and increased in number according to the need of the locality without any inconvenience.

Conclusions

1. Trachoma as an endemic disease is acquired in early infancy.

2. Faults in diet and personal hygiene added to local irritation are important elements in its causation.

3. For prophylaxis, local antitrachoma centers are of use.

76 Rue Faggala.

References

[1] Morax. Rev. Internat. der Trachome, 1931, v. 8, p. 1.
[2] Meyerhoff and Peretz. Rev. Internat. du Trachome, 1928, v. 6, p. 70.
[3] Wilson. Giza Memorial Laboratory Report, 1929, v. 4, p. 72.
[4] Pagès. Rev. Internat. du Trachome, 1934, v. 11, p. 44.
[4a] MacCallan. Brit. Jour. Ophth., 1931, v. 15, p. 370.
[5] Crisp. Amer. Jour. Ophth., 1933, v. 16, p. 545.
[6] Perdrau. Trans. Ophth. Soc. U. Kingdom, 1931, v. 51, p. 3.
[7] Cuénod and Nataf. Arch. d'Opht., 1933, v. 50, p. 224.
[8] Uudelt. Rev. Internat. du Trachome, 1934, v. 11, p. 170.
———. Zeitschr. f. Augenh., 1934, p. 277.
[9] Cattaneo. Rev. Internat. du Trachome, 1931, v. 8, p. 183.
[10] Mayou. Trans. Ophth. Soc. U. Kingdom, 1931, v. 51, p. 603.
[11] Puscariu. Rev. Internat. du Trachome, 1934, v. 11, p. 108.
[12] De Grosz. Proc. Staff Mayo Clinic, 1930, v. 5, pp. 303-306.
[13] Yudkin. Proc. 12th Ann. Conf. Amer. Nat'l Comm. Prev. Blindness, p. 83.
[14] Meyerhoff. Arch of Ophth., 1933, v. 9, p. 995.
[15] Pratt, O. Trans. Ophth. Soc. U. Kingdom, 1934, v. 54, p. 96.
[16] Stobie. Trans. Ophth. Soc. U. Kingdom, 1933, v. 53, p. 421.
[17] Wilson. Giza Memorial Laboratory Report, 1931, v. 6, p. 81.
[18] Hetler and James. Amer. Jour. Ophth., 1934, v. 17, p. 1054.
[19] Bywater and Holmes. Trans. Ophth. Soc. U. Kingdom, 1931, v. 51, p. 610.
[20] Galal Aboul Seoud. Bull. Ophth. Soc. Egypt, 1927, p. 201.
[21] Bishop Harman. Amer. Jour. Ophth., 1931, v. 14, p. 310.
[22] Worms and Marmoiton. Le trachome, p. 82 (étude par Parrot d'Alger, 1921).

NOTES, CASES, INSTRUMENTS

A SIMPLE NEEDLE FOR DIATHERMY TREATMENT OF RETINAL DETACHMENT*

HARRY S. GRADLE
CHICAGO

The majority of operators today are treating detachment of the retina by the production of an adhesive choroiditis by some form of diathermy. It is fairly well recognized that the current should be applied to the sclera, either superficially or partially penetrating. Complete penetration of the sclera with direct application of the current to the choroid is to be avoided on account of the extent of the resultant inflammation and on account of the leakage of the subretinal fluid with consequent softening of the eyeball before the operation is completed. Consequently, it is desirable to use either individual pins of the Walker or Safar type that are left in place until completion of the operation or else a single needle that does not perforate the sclera completely. To that end, more than a year ago, I devised the needle** here depicted, and have been using it with increasing frequency ever since.

The instrument consists of an insulated handle through which passes the insulated cord coming from the diathermy machine. At the end of the handle is an insulated steel wire, curved as shown in the illustration. Protruding backward from the end of the wire, at a moderately obtuse angle, is a platinoiridium tip, one-and-a-half millimeters in length. The tip is conical in shape, the base being about one-half millimeter in diameter, and the point as sharp as possible.

The use of this needle simplifies the operation enormously. The sclera is bared and marked according to the location of the area that is to be treated. Bridle sutures are passed under the recti muscles, thus avoiding the necessity of severing the muscles. The tip of the needle is then placed *obliquely* against the sclera and the current turned on. With slight pressure, the tip penetrates into the sclera from one third to one half of its length, but *not*

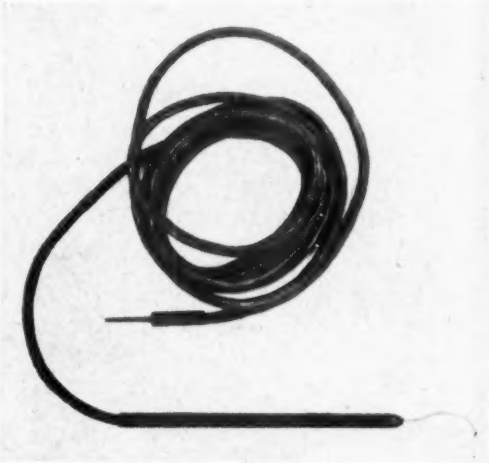


Fig. 1 (Gradle). Needle for the treatment of retinal detachment by diathermy.

through the sclera. After one to two seconds, the current is turned off and the needle withdrawn. In view of the obliquity of the tip, the current produces a superficial searing effect upon the sclera as well as the coagulating effects in the depths. A small amount of charred tissue remains adherent to the needle tip and this has to be scraped off after six to ten punctures. The application is then repeated as frequently as desired, according to the area that is to be sealed off. Owing to the curved form of the instrument, the punctures can be made as far posteriorly on the globe as the operator wishes, even without severing the muscles. Upon completing the desired number of punctures, the eyeball is punctured with a Graefe knife or the sclera is trephined, according to usage, and the subretinal fluid drained off. The postoperative treatment is the same as in other forms of detachment surgery, including the use of hole spectacles. The

* Submitted for publication July 26, 1935.
** The instrument is manufactured by V. Mueller & Co., of Chicago.

end results compare favorably from a statistical standpoint with those obtained by other methods.

A SPECIAL CLAMP FOR HOLDING LID SUTURES IN CATARACT OPERATIONS*

WARREN D. HORNER, M.D.
SAN FRANCISCO

The control of the lids by sutures in cataract operations offers certain definite advantages. These have been discussed by the author in a previous publication[1].

An ordinary hemostat was first employed to hold the sutures. A hemostat, however, is not designed to grasp threads transversely, hence equal tension on the four strands supporting the lid was frequently not maintained, particularly when they were properly spaced along the jaws of the clamp. If one converges the four sutures to a common point, an undesirable tendency to "tent" the lid is introduced.

The design of a clamp was therefore sought which would overcome this difficulty, which would be more easily held than a hemostat, and which would provide a simple means of utilizing a suture in the superior-rectus muscle.

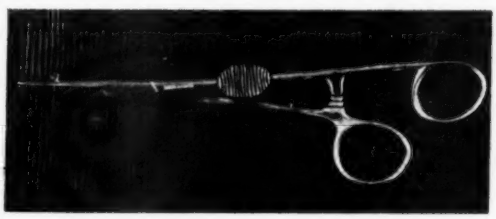


Fig. 1 (Horner). Clamp for holding lid sutures.

Inability to look down is so common, particularly following retrobulbar injection, that a superior-rectus suture is an important aid in cataract extractions.

The instrument illustrated amply fulfills these requirements (fig. 1). It consists of a modified hemostat with closely fitting jaws which will hold silk threads without slipping, throughout its entire grasping surface.

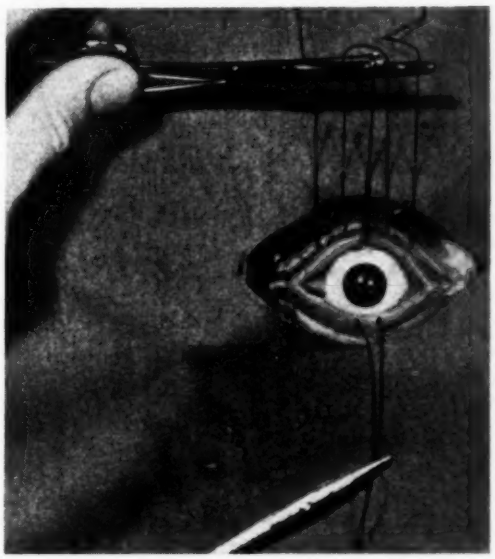


Fig. 2 (Horner). Clamp in position.

The handle is streamlined and may be comfortably held with either hand. It allows a variety of grips, depending upon the hand of the assistant.

The upper blade of the clamp, at its middle, bears a small hook open toward the point of the instrument. This acts as a pulley for the superior-rectus suture which changes its direction from a vertical pull to the horizontal. A corrugated plate offers a stop against which the suture is pressed by the thumb of the assistant with sufficient friction to maintain without slipping any given degree of tension. At the same time, the suture may be instantly released by simply lifting the thumb.

The use of the clamp is as follows:

A white-silk suture, double armed and 24 inches long, is inserted beneath the skin of the upper lid, 2 mm. from its free edge. Each needle penetrates the skin superficial to the tarsus, about 3 mm. on either side of the mid-line and emerges about 8 mm. away, running parallel to the lid margin. Thus the lid is supported by four strands, evenly

* From the Dept. of Ophthalmology, University of California Medical School.

[1] Horner, W. D. Sutures for lid control in cataract operations. Amer. Jour. Ophth., 1935, v. 18, Jan., p. 33.

spaced (fig. 2). These sutures are then clamped by the jaws of the instrument so that they equally support the arch-like contour of the upper lid. Lax strands are tightened and taut ones relaxed until equal tension is obtained.

One white suture, that is, two strands, is sufficient to retract the lower lid. These are caught by a mosquito hemostat and either clamped to the drapes or allowed to hang by its weight.

The tendon of the superior-rectus muscle is grasped by Elschnig or other forceps and secured by a long (18 in.) black-silk suture which is brought up through the ring of the hook and back across the face of the thumb plate. It is advantageous to knot the free ends of this suture.

The instrument is now lifted into position, so that the lid sutures are at right angles to its blades and the lid sufficiently and evenly raised (fig. 2). The superior-rectus suture is pulled upon, to force the eye downward and expose the upper limbus. This degree of tension is easily maintained by pressure of the thumb against the corrugated plate. Since two thumb plates are provided, the instrument may be used from either the right or left side.

Should the eye require sudden closure, the thumb is removed from the plate to release tension on the superior rectus and the lid drawn down by a lifting and depressing motion of the clamp. At the close of the operation the superior-rectus suture is first cut, followed by sutures number 1 and 4, which are cut close to the lid. Sutures 2 and 3 serve to keep the lid closed while the dressings are being applied, after which they are readily pulled out by further traction.

We employ routinely an oval, almond-shaped inner patch of cut gauze, 5 layers thick, which is moistened with saline, squeezed flat, and molded to the closed lids. This is followed by the usual eye patch. The inner patch soon dries and seems to prevent opening of the eye beneath the dressings.

I am indebted to my associates in practice, Doctors Frederick Cordes and David Harrington for their criticisms of the design of the instrument and to Mr. Carl Monkhouse and Mr. V. Mueller for their technical aid in making the necessary experimental models. The clamp may be obtained from Carl Monkhouse, 516 Market Street, San Francisco, or V. Mueller and Company, Chicago.

384 Post Street.

SOCIETY PROCEEDINGS

Edited by Dr. H. Rommel Hildreth

SAINT LOUIS OPHTHALMIC SOCIETY

February 22, 1935

Dr. Meyer Wiener, president

Parinaud's conjunctivitis

Dr. Harvey D. Lamb read a paper on this subject which will be published in this Journal.

Discussion. Dr. Max Jacobs asked Dr. Lamb if there were any cases reported by Meller regarding the culture of the blood in cases of this type. There might possibly be some reports in the literature regarding cultures made from the blood of such patients, which showed whether they contained bacilli.

He had seen two cases of conjunctival tuberculosis of the coxcomb type in a clinic abroad.

Dr. W. H. Luedde said there was a pseudo bacillus which resembled tubercle bacilli in chalazia.

Dr. Harvey Lamb said in answer to Dr. John Green that tubercular conjunctivitis resembled Parinaud's conjunctivitis to a very decided degree.

Convergent strabismus in which strong convex glasses were worn at an early age

Dr. J. E. Jennings said that his first patient, L. A., aged 7 years, was first seen when 10 months old. Under atropine the refraction measured +8.00 D.sph. in each eye. He had ordered +6.75 D.spheres in strong frames. These were worn constantly and corrected the strabismus. At the present time the vision in the right eye was 6/6, left eye 6/7.5. He attributed the satisfactory result to the early correction of the high hyperopia.

The second patient, R. L., was an 8-year-old boy who had been seen when 7 months old on account of strabismus and nystagmus. The atropine refraction measured +5.00 D.sph. ⌯ +3.00 D.cyl. ax. 90° in each eye. The glasses were worn constantly. Now the vision was O.D. fingers at 3 feet, O.S. 6/10. Shortly after the glasses were first ordered the strabismus disappeared, so the amblyopia could not be attributed to the strabismus but must be due to the nystagmus.

Discussion. Dr. John Green said there were some cases of strabismus associated with high hyperopia which would eventually diverge under full correction.

Dr. Joseph Charles had had a patient 22 years old, who was wearing a rather weak correction. He found that she needed a +8.00 D.sph. With full correction she had a divergent strabismus.

Dr. W. H. Luedde mentioned the case of a boy with convergent strabismus at 6 months of age. He used atropine and prescribed glasses at 11 months. This boy was watched until he was 18 years old, when he moved from the city. The parents of this boy would not consent to an operation and since the boy's vision was good in each eye it seemed wise to leave things as they were. It was his opinion that one could not put glasses on children too young. Dr. Jennings was right in saying that most cases did not develop in the first year of life, but later, perhaps at about 4 or 5 years.

Lipodystrophia progressiva with ocular complications

Dr. Joseph Charles reported a case of this condition. His paper will be published in this Journal.

H. Rommel Hildreth,
Editor.

COLLEGE OF PHYSICIANS OF PHILADELPHIA

Section on Ophthalmology

December 21, 1934

Dr. J. Milton Griscom, chairman

Comments concerning obstruction of the retinal veins

Dr. T. B. Holloway referred to ten cases illustrating various phases that

pertained to the symptoms, signs, and complications noted after obstruction of the central vein or its branches. He stated that in many cases if one could eliminate the fundus except for an area the width of the disc immediately surrounding that structure, it would be impossible to differentiate it from the papilledema noted in cases of brain tumor. While the site of the venous obstruction is usually just behind the lamina, Dr. Holloway thought that one should not lose sight of the possibility of the more posterior site as referred to by Mickel and Yamaguchi and as illustrated by Paton and Holmes and later by Fry.

Discussion. Dr. William Zentmayer said he believed no mention was made of the varying degree of hemorrhagic extravasation seen in these cases. In some instances, the entire retina is saturated with blood, whereas in others there are disseminated hemorrhages. This varying condition is probably due to the degree of obstruction and also to the weakness of the heart's action. In branch thrombosis, usually in the superior temporal vessel, the damage to vision is often as great as in obstruction of the central vein because the hemorrhage spreads into the macular area and disturbs the central vision.

Regarding the cause of the acute secondary glaucoma that supervenes in some instances, he thought that the generally accepted explanation of an increase in the albuminous content of the vitreous and aqueous is probably incorrect, for the attack is too long delayed. In iritis the same condition of the aqueous exists but acute glaucoma does not occur. Certainly the histologic findings in the cases quoted would explain certain instances.

While in general Dr. Holloway's opinion that these eyes usually require enucleation is correct, in two instances Dr. Zentmayer succeeded in saving the eyeball by performing a cyclodialysis and then, while the tension was reduced, an iridectomy. Of course the result of any operation which suddenly decompresses the eye would be disastrous. The life tenure in these cases is good, many of the patients living from six to twelve years after the development of the eye trouble.

Dr. Maxwell Langdon said that about five years ago, in a very short period of time he saw three cases of thrombosis of the central vein of the retina in each of which there developed an acute rise in tension; later in each of these cases a moderate rise in tension developed in the fellow eye; in other words, the eye which did not have the thrombosis developed a simple, chronic glaucoma. He then conceived the idea that it was possible that increased tension might appear in the eye which had had the thrombosis of the central vein but which had previously had a tendency to increase tension. He therefore, took the tension in every case of thrombosis of the central vein as soon as he saw it and invariably found it well within the normal limits both in the affected and unaffected eyes, showing to his mind that there must be some secondary development to produce the increased tension which so frequently follows this condition of the retinal vein.

The nerve messages from sense organs

Dr. D. W. Bronk stated that modern biophysical methods have made possible new and fruitful investigation concerning the peripheral mechanism of sensation. By recording the action potentials in single sensory nerve fibers it has been possible to intercept the sensory nerve messages from the individual receptors and thus to determine the nature of the nervous effects which give rise to sensation and to analyze the properties of the receptors. Of special interest to the ophthalmologist is Hartline's recent application of these methods to single photoreceptors in the vertebrate retina.

The characteristic sensory nerve message is a train of impulses following one another at a definite frequency. The variables in this message which signal variations in intensity of the stimulus are the number of sense organs in action and the frequency of impulses from the single receptor. Thus, the stronger the stimulus, the greater the number of receptors stimulated, inasmuch as

those with higher threshold are then brought into action. And secondly, the stronger the stimulus, the higher the frequency of discharge from the individual receptor. This frequency, however, is not constant for any given intensity of stimulus but gradually declines with time. This therefore accounts, at least in part, for the phenomenon of adaptation. On the basis of these results it is now possible to say that the intensity of sensation is, in general, a function of the total number of afferent impulses going into the centers.

If these sensory-nerve messages from various sense organs are all of essentially the same general character, the very important question arises as to what is the afferent basis for different qualities of sensation. There are, it is true, certain important differences in the nervous discharge from different types of receptors. For instance, the tactile receptors adapt themselves very much more quickly to a constant stimulus than do the photoreceptors in the eyes. Nerves impulses coming from different types of receptors have somewhat different time constants, and the thresholds of different sense organs are quite different for the various types of stimuli, as is shown, for example, by the fact that some photoreceptors are very much more easily stimulated by certain wave lengths of light than are others. But probably the most important factor in this matter of quality discrimination is where in the central nervous system the afferent impulses finally end. Because of this consideration one must assume that the whole pathway is involved in determining the character of the results.

A. G. Fewell,
Clerk.

LOS ANGELES SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

March 25, 1935

Dr. Walter Crane, president

Motion pictures of eye operations

Drs. W. A. Boyce, H. F. Whalman, R. O. Bullis, and William Endres showed motion pictures of a series of operations performed at the Los Angeles General Hospital. The first was that of a trephining in accordance with the method of Colonel Elliot for chronic simple glaucoma. Cyclodialysis was performed on the opposite eye in accordance with the method of Professor Anton Elschnig of Prague. Next in the series of pictures was the Elschnig intracapsular operation for cataract.

The orthoptic and surgical management of strabismus

Dr. J. P. Lordan reported a series of sixty cases in which preoperative orthoptic training had been given and operative treatment in accordance with the cinch-shortening operation of Roderic O'Connor. Dr. Lordan stated that for the shortening, he originally used a cable of fourteen strands of 000 medium dermal suture material which he found difficult to handle, and that later, on the advice of Dr. O'Connor, this number was reduced to 8 strands with a resultant greater ease of manipulation and apparently almost as much shortening effect. Occasionally, only two or three strands had been used when a low degree of shortening was desired. The subcapsular tenotomy demonstrated by Dr. Lordan consisted of exposing the capsule of the muscle and making a longitudinal opening in it. The muscle was split and each half fished out with a hook and nicked in succession to within about 2 mm. of the lateral borders of the tendon. Another type of central tenotomy, such as the one performed by Dr. George N. Hosford of San Francisco, consisted in exposing the tendon more completely and procuring the desired amount of severance under direct vision. He described a third method, that of making central and lateral incisions in the tendon, and a fourth in which a complete tenotomy was performed, the tendon being cut off completely near the scleral attachment, allowed to go free in some cases, and guarded in others by a black-silk stay suture passed from the tendon into its stump.

Dr. Lordan concluded that when orthoptic methods are systematically pur-

sued, they are of assistance. For the shortenings, the O'Connor technique had proved very satisfactory, averting a long period of disability, and necessitating only one day's hospitalization. Cinch shortening and central tenotomy combined corrected about 20 degrees of deviation. Central tenotomy under direct vision, in accordance with the method of Hosford, is the most satisfactory to perform and gives the best result. Complete and guarded tenotomies are the least satisfactory, overcorrection occurring in five cases. Out of sixty cases treated, fifty-five had resulted in cosmetically straight eyes. Several of the remaining five could have been improved by further operation, but in some instances this was not desired by the patient.

Harold F. Whalman,
Recorder.

NASHVILLE ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

March 15, 1935

Dr. Kate Savage Zerfoss presiding

An unusual case of glaucoma

Dr. W. G. Kennon presented F. A., aged 41 years, a white man who was first seen on April 23, 1934. He had awakened in the morning of that day with severe pain in the left eye. He was seen by Dr. Wilkes in the morning and was found to have acute inflammatory glaucoma. Pilocarpine and eserine solutions were administered. There had been no relief from pain except by the use of morphine.

The pupil was widely dilated, the cornea steamy and not sensitive to the touch. An opthalmoscopic examination was not possible. Iridectomy was advised and performed. At the time of operation the lens was thought to be dislocated into the anterior chamber. This proved to be true later when the steaminess of the cornea subsided and a better view could be obtained. During the operation the lens was injured and an opacity of this structure could be seen lying almost entirely in the anterior chamber. Convalescence from the iridectomy was without unusual features. On May 4, 1934, the lens was extracted, a loop being used. There was but slight loss of vitreous.

On June 6, 1934, the patient came in with absolutely the same sort of story in regard to the right eye. This eye varied in no respect from the previous condition of its fellow except that the lens did not seem to be in the anterior chamber at the time the iridectomy was performed. The next morning, however, the lens, which was perfectly clear, was found to be tilted forward above and was located almost entirely in the anterior chamber. On June 11, 1934, this lens was also extracted. There was a spontaneous extrusion of the lens in the eye as soon as the corneal section was completed, but without loss of vitreous. Convalescence was uneventful.

With suitable cataract lenses his vision when last seen about six months ago was 20/20 in each eye. This patient had had a myopia of eight diopters previous to operation, and vision of 20/30 in each eye with correction.

Kate Savage Zerfoss,
Secretary

CHICAGO OPHTHALMOLOGICAL SOCIETY

March 18, 1935

Dr. E. V. L. Brown, president

Bilateral chronic glaucoma

Dr. Hallard Beard presented Mrs. M. K., 83 years of age. She complained of a gradually progressive loss of vision in both eyes over a period of several years. The vision was O.D. 6/200, O.S. nil. External examination was negative except for rather large, sluggish pupils. The lenses were clear. The optic disc in each eye was deeply cupped, the cup having a marked ampulliform character, as in advanced glaucoma. The field of vision of the right eye was contracted to within 10 or 15 degrees of the fixation point. Tests of ocular tension in both eyes yielded figures well within normal limits, 15 to 21 mm. Prolonged use of mydriatics had failed to

produce the slightest increase in the ocular tension. The conclusion in this case was that it was a bilateral chronic glaucoma and that the cause which originally had operated to increase the intraocular tension had disappeared some time since.

Discussion. Dr. E. V. L. Brown mentioned a case seen some time ago, a bilateral ampulliform excavation with normal tension in a patient blinded from acute methyl-alcohol poisoning. There was no tension above 13 mm. through ninety consecutive days. He now had under observation such a bilateral ampulliform excavation in a man of 77 years who still had useful vision and no increased tension after fourteen years. This case might be of the type described by Roenne, in 1921, as arrested congenital glaucoma.

Pigmented nevus of the lids

Dr. Hallard Beard presented a girl, 18 years of age, with a large pigmented nevus involving both upper and lower lids of the right eye. This patient had been referred by a dermatologist, in whose opinion radium or other radiation would be of little avail. A plastic operation to remove the growth and repair the defect was projected. A difficulty, however, presented itself when it was found that pigmentation extended throughout the entire thickness of the lids, appearing on the conjunctiva.

Discussion. Dr. Robert von der Heydt thought that this was a condition for a dermatologist and not an ophthalmologist. In his opinion it would be a great mistake to operate, but much could possibly be accomplished by radium. That would, however, cause a late cataract. The patient therefore had the choice of possibly losing the lens of that eye or remaining in the present condition.

Nevus flammeus and hydrophthalmos

Dr. M. L. Folk presented a young woman, 18 years of age, who had had a large right eye with poor vision since birth. Examination revealed the anterior segment of the right eye to be much larger than the left. The right cornea measured 15 x 16 mm., the left 11 x 12 mm. The right anterior chamber was very deep, the iris the same size as the cornea, and the pupil 8 mm. in diameter. The right disc showed typical glaucomatous cupping. The tension of the right eye was 38 mm., of the left 25 mm. The vision of the right eye was 3/200, and the visual field nasally was almost entirely gone. The left eye was normal and the vision 1.5—4. Under pilocarpine the tension of the right eye was brought down to 28 mm. An Elliot trephining was performed successfully.

The association between nevus flammeus and glaucoma has been known since 1860 when Schirmer reported his first case. As to the connection between the two conditions there are several theories. The most popular one, sponsored by Elschnig, Ginsberg, and others, is that there is an increased number of vessels in the choroid leading to plethora and increased transudation. Hudelo believed that there is an angiomatosis around the cavernous sinus, obstructing the return venous circulation. Safar and Marchesani held that there is no direct connection between the above conditions and that they are coexistent congenital anomalies. Whichever the case might be, in the presence of a nevus flammeus one should look for glaucoma on the side of the lesion.

Dermoid cyst of the orbit

Dr. M. L. Folk presented a 22-year-old woman with an exophthalmos which had existed since her seventh year; it had progressed until puberty and then had become stationary. Examination revealed a marked exophthalmos of the left eye. The eye diverged 50 degrees and deviated upward. It presented an optic atrophy and vision of 6/200; the right eye was normal. After thorough study of the orbit and the sinuses, an exploratory operation was performed through the nasal conjunctiva where the mass was felt. A large cyst, 5 to 6 cm. in diameter was found springing from the muscle cone. The capsule ruptured at the time of the excision and a large amount of sebaceous material escaped. The wall of the

cyst was removed *in toto* and was found to contain several hairs. At a subsequent date a tenotomy of the left external rectus and resection of the left internal rectus were performed, which decreased divergence from 50 to 20 degrees. Later on, another anchored tenotomy of the left external rectus and a tucking of the inferior rectus were performed. The patient now presented only 10 to 15 degrees of divergence, the eyes were on the same horizontal level, and there was some enophthalmos.

Congenital melanoma of the choroid

Dr. Richard Perritt presented a man 36 years of age, first seen on February 25, 1935, with vision O.D. 20/40, O.S. 20/25.

In the right eye, adjoining the disc on the temporal side and reaching beyond the macula, there was a large circular pigmented area about 3 disc diameters in height and width. The retina overlying this area was normal in appearance and intact, as seen with white light. In places the red reflex of the choroid showed through in small patches. No inflammatory nor degenerative changes were seen. Transillumination was negative. Tension was 17.0 mm. in each eye.

Leber's disease (?)

Dr. Carl Apple showed two brothers, 9 and 7 years of age, with complaints of impairment of vision of one year's duration. The older boy's vision was counting fingers at one foot; the younger boy had a vision of O.D. 0.6; O.S. 0.1. There were seven children in the family, four boys and three girls, but these two were the only ones afflicted. In the older boy both eyes were involved, in the younger the left eye only. Both had definite atrophy of the discs and a moderate salt-and-pepper appearance of the fundi. There were central scotomata for red in both cases. The peripheral fields of the younger were contracted, and the color field markedly so. Physical, neurological, and serological examinations were negative. All other members of the family had negative Wassermann tests.

Discussion. Dr. Robert von der Heydt said that Leber's disease was a definite clinical entity, hereditary optic atrophy found in males, usually from 15 to 26 years of age, and characterized by an acute toxic retrobulbar neuritis, toxic in the sense that it was inflammatory. There was an acute stage of from three to six months, then it settled down to central blindness. One of these boys had central vision and peripheral blindness. That could hardly be classified as Leber's hereditary optic atrophy. The peripheral retina of one boy had a salt-and-pepper appearance. The macula looked normal and optic atrophy was marked. The one boy had normal visual acuity, and that was unusual in Leber's hereditary optic atrophy.

Effects on the pupillary reaction of lesions in the posterior commissure

Dr. Leo L. Mayer and Dr. H. W. Magoun (by invitation) read a paper on this subject which was published in this Journal (July, 1935).

Newer developments in photography of the eye

Dr. William A. Mann read a paper on this subject which will be published in this Journal.

Robert von der Heydt

MEMPHIS SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

March 12, 1935.

Dr. W. D. Stinson presiding

Webster operation for entropion

Dr. R. O. Rychener presented Miss V. B., aged 34 years, who had been operated on the previous day for cicatricial entropion of both upper lids. She had been under treatment elsewhere for trachoma for the past fifteen years, and the upper lid margins had been scalped about ten years previously. Some lashes persisted and the buckling of the tarsal plates had produced corneal irritation, although the conjunctiva was smooth and free of granulations.

Mucous-membrane grafts from the lower lip were laid in tarsal incisions

after Webster's method and remarkable improvement was immediately apparent.

The effect on the left eye which had always been the better eye, and in which the cornea was so vascularized as to hide any details of the iris, was almost magical, as the vision was improved from light perception to 5/60 and the iris was now easily seen.

Conjunctivitis of unknown etiology

Dr. E. C. Ellett reported A. H., aged 24 years, whose complaint since September had been watering of the eyes. He was first seen on January 7, at which time the only change found was a granulation of the upper fornix of each eye. He had been treated with copper sulphate, the left lid had been rolled, and he had had one X-ray treatment to the left lid. On February 25, he developed a small corneal ulcer in the left eye which had just healed.

Discussion. Dr. J. B. Stanford and Dr. D. H. Anthony had both previously treated this patient with various astringents without any relief. The main symptom had been lacrimation.

Dr. P. M. Lewis commented on the tendency toward pavement block formation of the granulations, and suggested the possibility of an atypical vernal conjunctivitis.

Dr. Ellett (closing) thought the diagnosis of vernal conjunctivitis probably correct, although the symptoms were not those usually attending this affection. A smear of the conjunctival scrapings showed a number of eosinophiles.

Malignant melanoma of choroid

Dr. J. B. Stanford reported the case of Mr. I. B. T. who had lost most of the vision in his left eye in the spring of 1933. In October, 1934, the eye had become red and painful, the condition growing worse until he was seen on November 18, 1934. All the signs of acute glaucoma were then present, including tension of 52 mm. Hg. There was a very faint fundus reflex. Trephining was advised and the patient was warned that a tumor might be the cause of his trouble. The following day the eye was trephined satisfactorily, but there was no relief from pain, and little, if any, reduction of tension. Later the eye was enucleated under local anesthesia, but the enucleated eye was so clear under transillumination that the presence of a tumor was doubted. When examined, however, by the Army Medical Museum, a mushroom-shaped, moderately pigmented, malignant melanoma of the choroid was found.

Inclusion-body conjunctivitis

Dr. J. B. Stanford reported that on February 21, 1935, he was called to the Methodist Hospital to see a baby girl, six days old, who had had an inflamed left eye for three days. The smear showed B. xerosis alone. A zinc solution was prescribed, and a diet for the mother to increase the vitamin content of the milk. There was little change until March 3, when both eyes were infected and there was some bleeding from the left conjunctiva. Since then both eyes had bled rather freely. A smear on the third showed much pus but no organisms. On March 5, a smear showed inclusion bodies. On March 8, there was more swelling of the right lids. An intramuscular injection of lactigen was given, followed by decided improvement of both eyes. Several local applications of one half of one percent silver nitrate had been given to both eyes without apparent improvement.

Discussion. Dr. R. O. Rychener commented on the frequency of such infections in which negative smears and cultures were obtained. He thought many such cases were too zealously treated and he had obtained some excellent results with nothing but frequent, thorough lavage with boric-acid solution.

Dr. Stanford (closing) thought that inclusion-body infections would be found to be of venereal origin and doubted that cases which improved under simple irrigation would be found to be in that group.

Retrobulbar neuritis

Dr. A. C. Lewis reported the case of Mrs. H. A. J. whose vision in the left eye was finger counting at one foot. The

left disc was congested and its margins blurred but there was no choking. The nasal examination was negative to inspection, transillumination, and suction; the tonsils were questionable. Several teeth in the upper jaw had never erupted. The urinalysis and Kahn test were also negative.

On March 4, there was no light perception and the nerve head appeared more inflamed. He then removed the left middle turbinate, all possible ethmoid cells and opened widely the left sphenoid sinus. One week later the vision had returned to finger counting at ten feet.

Retrobulbar neuritis

Drs. John T. Shea and J. B. Stanford reported the case of Mr. T. B. S., 31 years old, who had lost the vision of his left eye rather suddenly on Christmas day. There was a history of some rather serious nasal trouble. The vision of the affected eye was limited to the perception of moving objects. The eye appearing normal in every way, a diagnosis of retrobulbar neuritis was made.

The left middle turbinate was removed and a complete exenteration was attempted of the polyps and degenerated ethmoid cells. The anterior wall of the left sphenoid was completetly removed. On the right side, an intranasal exenteration of the ethmoids with the retention of the middle turbinate and a less extensive sphenoid operation was done. By March the central vision of the left eye had improved to 20/70-1 and the fundus was normal.

Discussion. Dr. P. M. Lewis wondered why so many cases of retrobulbar neuritis were locally found to be due to sinus disease whereas in the north and east, multiple sclerosis was considered to be the etiology.

Dr. E. C. Ellett said that in his experience sinus disease had been uncommon as the cause of retrobulbar neuritis. Frequently the general examination yielded no evidence of pathology anywhere and most cases recovered if no surgery was done. The internal administration of mercury and iodide had been most valuable in his practice.

Tuberculous iridocyclitis

Dr. R. O. Rychener said that Mrs. G. McR., aged 26 years, was seen June 27, 1934, because the left eye had been red and painful for the previous six weeks. Mild ciliary injection was present. There were large mutton-fat deposits on the posterior corneal surface, also posterior synechiae with a weblike gray membrane over the lens surface through which a fundus reflex but no details were visible. The iris from the "7 to 2 o'clock" position was occupied by an apple-jelly-colored granulomatous mass, containing small blood vessels. Vision was moving objects, tension 43 mm. (Schiötz). The right eye was entirely normal.

General physical examination including a roentgenogram of the chest was entirely normal. Tuberculin therapy was tried over a period of three months. Mixed treatment was administered internally with atropine and dionine locally.

On August 27, 1934, the patient returned insisting on enucleation because of pain. A necrotic ulcer of the limbus was present which seemed to involve the sclera more than the cornea. The anterior chamber was filled with a dense lardaceous exudate with some hyphemia in the lower angle. The eye was enucleated.

The eye was examined at the Army Medical Museum and the report stated that there was an intense plasma-cell infiltration in the edges of the corneal ulcer and in the iris. Near the ciliary body were localized areas of epithelioid-cell infiltration containing typical Langhan's-type giant cells. The partly absorbed cataractous lens was surrounded by an inflammatory-cell exudate, the exudate extending along the anterior part of the choroid to the equator. Patches of large mononuclear-cell infiltration occurred throughout the extent of the retina.

R. O. Rychener,
Secretary.

AMERICAN JOURNAL OF OPHTHALMOLOGY

PUBLISHED MONTHLY BY THE OPHTHALMIC PUBLISHING COMPANY

EDITORIAL STAFF

LAWRENCE T. POST, Editor
640 S. Kingshighway, Saint Louis
WILLIAM H. CRISP, Consulting Editor
530 Metropolitan building, Denver
EDWARD JACKSON, Consulting Editor
1120 Republic building, Denver
HANS BARKAN
Stanford University Hospital, San Francisco
HARRY S. GRADLE
58 East Washington street, Chicago
H. ROMMEL HILDRETH
824 Metropolitan building, Saint Louis
PARK LEWIS
454 Franklin street, Buffalo
M. URIBE TRONCOSO
350 West Eighty-fifth street, New York
*M. F. WEYMANN
903 Westlake Professional building, Los Angeles
JOHN M. WHEELER
635 West One Hundred Sixty-fifth street, New York
EMMA S. BUSS, Manuscript Editor
4907 Maryland avenue, Saint Louis

Address original papers, other scientific communications including correspondence, also books for review and reports of **society proceedings** to **Dr. Lawrence T. Post, 640 S. Kingshighway, Saint Louis.**

Exchange copies of medical journals should be sent to **Dr. William H. Crisp, 530 Metropolitan building, Denver.**

Subscriptions, applications for single copies, notices of change of address, and communications with reference to advertising should be addressed to the **Manager of Subscriptions and Advertising, 640 S. Kingshighway, Saint Louis.** Copy of advertisements must be sent to the manager by the fifteenth of the month preceding its appearance.

Author's proofs should be corrected and returned within forty-eight hours to the **editor.** Twenty-five reprints of each article will be supplied to the author without charge. Additional reprints may be obtained from the printer, the George Banta Publishing Company, 450-458 Ahnaip street, Menasha, Wisconsin, if ordered at the time proofs are returned but reprints to contain colored plates must be ordered when the article is accepted.

* Deceased.

THE OPHTHALMIC VITAMIN

Keratomalacia was for many years a reasonable name for the softening, ulceration, and opacities of the cornea occasionally seen in anemic, poorly nourished, and sick children. With recognition of the existence of vitamins essential to health and growth, it began to be observed that these children had been kept on a diet deficient in fats. Our knowledge of the condition has gradually increased, until it was known that keratomalacia depends mostly on lack of the fat-soluble vitamin A, which has been called the ophthalmic vitamin.

This was the state of our knowledge when, in 1923, Blegvad called attention to the epidemic that occurred in Denmark, during the World War. He summarized and analyzed the reports of 434 cases in children, and 19 in adults. The export of milk and butter, during the war, left the children and mothers of Denmark living on a diet of substitutes for milk fats that were very deficient in vitamin A. Preceding the occurrence of keratomalacia, the patients always showed loss of weight. Of those that survived 27 percent were blind, but 35 percent retained sight in one eye, although in 67 percent both eyes had been attacked.

In his lectures on "Blinding diseases of childhood," delivered in 1934, at Madras University, Lt. Col. R. E. Wright gave first place to the "avitaminosis, known as keratomalacia, so largely responsible for preventable blindness in children," in the greater part of India and in China. The earliest symptom, night blindness, is quite generally overlooked in young children. The child later treated with cod-liver oil may be restored to health; but remains blind. Such cases are likely to be presented, years later, with corneal leucoma or staphyloma, when it is not always possible to determine with certainty the original condition that caused the blindness. There were pre-

sented at the Madras Government Ophthalmic Hospital, in one year, 30 children totally blind and 33 others practically blind from this condition.

Blindness from vitamin-A deficiency is less common in Europe and America; but among the depressed, undernourished classes it may be more common than we suspect. Blegvad proposes to call the condition a "dystrophy hemeralopia." But he recognized the great importance of the corneal lesions. The term avitaminosis is appropriate for all the principal changes that are known of the pathology of these cases. But at the 1935 meeting of the Association for Research in Ophthalmology, there was presented a study of congenital anophthalmos in pigs that fully entitles the fat-soluble vitamin A to the name the Ophthalmic Vitamin. This paper will appear in full in a subsequent number of the American Journal of Ophthalmology, but it is such a complete study of its subject that it deserves advance notice as a model for thoroughness in scientific research.

At the Texas Agricultural Experiment Station the experiment was tried of breeding sows that had been kept on diet devoid of vitamin A for 160 days before and 30 days after breeding. Of 35 pigs farrowed in 3 litters, all were blind. In one litter, 14 pigs, some eyes were present, but all were deformed and sightless. This sow became ill, and two weeks before breeding, was given one dose of cod-liver oil. She quickly recovered strength, but her pigs were sightless. Control experiments, with feeding including cod-liver oil, gave normal litters. Some of the eyeless pigs, bred under conditions of normal feeding, gave litters of pigs with normal eyes. Hereditary tendencies could be excluded from the strains used. No other blind pigs had been farrowed at the Experiment Station in ten years. One of the sires was Duroc and the other Essex, and their pigs by healthy sows all had normal eyes. For new discoveries in ophthalmology we may well watch other fields of study in science.

Edward Jackson.

THE CINCINNATI MEETING

The fortieth annual session of the American Academy of Ophthalmology and Otolaryngology became history on September 20th. An excellent meeting was held in a very satisfactory location. Headquarters was in an attractive and adequate hotel. A large part of the registrants were able to find accommodations there, and those who were unable to do so were housed near by. Cincinnati is advantageously located for Academy meetings, being within overnight travel by train from most of the principal Eastern and Midwestern cities. The attendance was not quite up to expectations, but by Wednesday afternoon almost nine hundred had registered. Perhaps the hot weather was one reason why a larger number was not attained.

There are few American cities that do not occasionally have very warm spells in September. It is probable that better hotel rates can be obtained during that month because September is somewhat "off season," but October is certainly the pleasanter month. We can all recall some recent meetings that have been handicapped severely by heat. Of course there are other arguments for September; such as the fact that medical schools have not opened then, and a possible conflict with the American College of Surgeons meeting in October.

The next Academy meeting is to be held in New York in October, 1936, not too early in the month, we hope. This should be a popular location and date —especially for the wives and daughters who like an excuse to go to that metropolis. The last meeting in New York was in 1909, hence few of the present membership will recall it. No "extra-curricular" activities need be provided, as the city's attractions will prove difficult competition. Even the banquet will probably suffer from this to a considerable extent. We hope not too much, because this is an important feature of the program, perhaps chiefly for its unifying effect. It is the outstanding formal gathering in which the whole membership joins and at which may be seen the officers and distin-

guished guests. One other word might be added about this banquet. The attendance is not what it should be, as usually only about half of the registrants are there, perhaps largely because of the expense, five dollars being no inconsiderable sum these days. It might be recalled that Academy dues are low and expenses high and that the banquet charge may be an indirect tax for the benefit of the Academy, so that the purchase of a ticket not only assures the member a pleasant evening but is a gesture of loyalty.

The banquet this year was on Wednesday evening, as usual. It was held in "The Hall of Mirrors," which figured at other times as the Convention Hall. Speeches were short and interesting; the music was excellent. A huge birthday cake had been made in honor of the twenty-fifth birthday of the Academy, twenty-five years having passed since its organization as a national society in the same city.

A tribute was paid to Drs. Christian Holmes and Derrick T. Vail, Sr., honored as having been largely instrumental in this broadening of the Academy, which had been founded by fifty physicians as the "Western Ophthalmological, Otological and Laryngological Society," in 1896, in Kansas City, Missouri, with Doctor Adolph Alt of St. Louis, first president and Doctor Hal Foster, Kansas City, secretary. In 1903, the name was changed to that by which it is now known. The membership then was 185, while now it is approximately 2265.

The Official Program appeared in the best form yet presented. Indexed by indents, the desired page was more readily located than heretofore. Much information was contained in the booklet, which was made conveniently of pocket size.

As to the program, the editor can speak for only a small portion of it, not at all for the otolaryngological half. The papers that he did hear were unusually good. The courses were carefully chosen, interesting, and well attended. The best are those which give the experience of the lecturer. Reviews of the literature are less interesting.

On Tuesday evening there was informal entertainment. If the lateness of the "break up" is a true indication of the enjoyment, the occasion was surely a success. The humorous speeches and the solos in the earlier part of the evening were unsuccessful because of the noise and confusion in the rear of the room. The guest of honor must have been somewhat embarrassed at the failure of the audience to be attentive during his piano solo. There is considerable excuse in that it is rather difficult to be quiet and a good listener after a day of attention and listening. Band music and some entertainment requiring little or no concentration, especially of the auditory apparatus, would perhaps be better suited to this party. Fortunately, the evening was soon given over to dancing and conversation, aided by an unlimited supply of Cincinnati's excellent brew, and "a good time was had by all."

Dr. Frank Burch was nominated president and Dr. Lee Wallace Dean, president elect. No more capable men could have been chosen for the most important office of the Academy and undoubtedly they will "hold high the torch."

In passing we cannot fail to comment on the list of those who have served the Academy well but are with us no more. Three seem to deserve special mention: Clarence Loeb, for many years efficient editor of the Transactions of the Academy and associate editor of this Journal; Bill Mullin, active secretary of the Otolaryngological section, always fun loving and a tonic in himself; and lastly Morie Weymann, third vice president for 1935, an active editor of the Journal, and one of the most promising of the younger ophthalmologists. We missed them greatly and shall continue to miss them.

The Academy goes on. It is conducted with vision, energy, enthusiasm, and unselfishness. As long as this spirit prevails the organization will flourish.

Lawrence T. Post.

BOOK NOTICES

The doctor's bill. By Hugh Cabot. Cloth covers, 313 pages, Columbia University Press, New York City, 1935.

This book presents the subject of medical economics in a very satisfactory and fair manner. After a brief history of medical practice from 1890 to 1930, various phases of the medical situation in the United States and other countries are given. The change in the nature of practice, the broadened field of specialization, and group medicine are considered. Health services and workmen's compensation acts are described and some attempt at evaluation made. The income of the physician and the ability of the laity to pay for adequate medical care are discussed. The last three chapters are devoted to considering the various possibilities.

The author has had a broad experience and his opinion is entitled to serious consideration. Much of his material is derived from the Report of the Committee on Medical Education. He rather decries the attitude of the American Medical Association in its opposition to such changes as suggested in the majority report, and especially the brusque reception of the report of the Medical Service Board of the American College of Surgeons, in June, 1934.

Undoubtedly there was much to be said on both sides of that controversy. The attitude of the American Medical Association has certainly been modified somewhat in the past year.

The book is interestingly written and valuable for acquainting the physician with certain facts related to the problem. The author's suggestions are conservative and the book is more an attempt to indicate signposts than to urge new departures. Probably radical changes in the old system would be inadvisable but there are gradually evolving more efficient methods of handling the health of our people in this rapidly changing world.

Lawrence T. Post.

OBITUARIES

Clarence Loeb, 1876-1935

Dr. Clarence Loeb was born in Columbia, Mo., on March 21, 1876, of a family which has contributed its full share to the learned professions. His older brother, Hanau W., was a famous otolaryngologist and at one time the dean of St. Louis University Medical School. Another brother, Isidor, is professor and dean of the School of Commerce and Administration, of Washington University, in St. Louis. A third brother, Virgil, is a well-known oral surgeon of that city.

Dr. Clarence Loeb

Upon the completion of his high-school studies Clarence entered the University of Missouri, from which he received his A.B. degree, cum laude, in 1896, and A.M. in 1897. In 1899, he was graduated in medicine from the Marion Sims College, later the University of Missouri. After having served his internship in the St. Louis City Hospital, he went abroad for the study of ophthalmology in Berlin and Vienna during 1901-2. Upon his return to this country, he associated himself with the St. Louis University, where he later became assistant professor of ophthalmology. He also served as ophthalmologist to the St. Louis City Hospital, to Alexian Brothers Hospital, and to Mount St. Rose Sanitarium. During that period he was instrumental in establishing the Missouri Association for the Prevention of Blindness, of which he was one of the first officers.

At the time of the World War he served as First Lieutenant, at the M.R.C. Mobilization Camp, in Nevada,

Mo., and later on the Medical Advisory Board for Selective Service in Chicago. In 1918, one year after his removal to Chicago, he was appointed Associate Ophthalmologist and director of the Eye Dispensary of the Michael Reese Hospital, and in 1923, was promoted to the rank of attending ophthalmologist.

From the earliest period of his medical career, Dr. Loeb displayed great interest in current ophthalmic periodicals, to which he devoted a good deal of time and energy. His literary ability was soon given recognition and he was appointed Associate Editor of the American Journal of Ophthalmology, which office he held until his illness, in 1928, forced him to retire. For a number of years he also served as Treasurer of the Ophthalmic Publishing Company and was Corresponding Secretary of the Chicago Ophthalmological Society. He was Editor of the Transactions of the American Academy of Ophthalmology and Otolaryngology from 1919 to 1929, supervising the last editions from his bed, to which he had been confined by his last illness.

His contributions to ophthalmic literature consist of twenty-six original articles, a number of editorials, and case presentations before the various societies. His first article appeared in the "Archives of Ophthalmology" in 1903, and was entitled "The value of ophthalmoscopic examinations in the differential diagnosis between typhoid fever and acute miliary tuberculosis." He wrote a good deal on ophthalmic education and contributed to text books. His most outstanding work was, probably, a series of four articles on "Hereditary blindness and its prevention" published in the "Annals of Ophthalmology" in 1909, and later appearing in the form of a monograph. His last important work was the translation of Ernst Franke's book "Ocular therapeutics," in 1925.

Dr. Loeb was a man of sterling uprightness and unimpeachable character, strictly ethical in his relations with his fellow practitioners and straightforward in his dealings with his fellow men. As an executive he was strict and stern, demanding of his associates the same accuracy in the performance of their duties that he himself was wont to accord them, but he was always fair and just. Interest in clinic work persisted throughout the passing years and he very seldom absented himself from the dispensary, not even to take a vacation during the hot summer months. His attitude to his clinic patients was just as kindly, and as courteous, as to his private patients, and he treated them as conscientiously. His favorite hobbies were bridge, golf, and reading. One seldom saw him without a book in his brief case or under his arm.

He died May 26, 1935, from a cardiovascular-renal disease lasting seven-and-one-half years, throughout which he maintained his courage, good humor, and dignity. His untimely death is a great loss to ophthalmic literature.

M. L. Folk.

W. T. Holmes Spicer

William Thomas Holmes Spicer, who was in his seventy-fifth year, died at his home in Wimbledon, August 8, 1935. He was born and grew up in Essex. He took the Natural Science course at Cambridge University, and graduated with honors in 1880. He studied Medicine at Saint Bartholomew's Hospital, where he was Ophthalmic House Surgeon. He received the degree of M.B. from Cambridge in 1884, and was made Fellow of the Royal College of Surgeons in 1888. After a few years in general practice he turned to ophthalmology, and became clinical assistant at Moorfields, and ophthalmic surgeon to the Metropolitan Hospital and Victoria Hospital for Children. In 1898 he was elected Ophthalmic Surgeon to the Royal London Ophthalmic Hospital, succeeding Nettleship, with whom he had been closely associated. He became Dean of the Staff, and was active in organizing and extending the instructional work of that institution. In 1901 he became junior, and later senior Ophthalmic Surgeon to Saint Bartholomew's Hospital, and in 1920, when retired under the age rule, was appointed a governor of that institution.

In 1889 he joined the Ophthalmological Society of the United Kingdom.

The next year he prepared an index for the first ten volumes of its Transactions; and such an index has been prepared, by younger men, each ten years since. The Transactions of the Society include seventy-five communications from Holmes Spicer. He edited the later editions of "The diseases of the eye," by Nettleship, and contributed to the "Diseases of the eye, nose, throat and ear," edited by Posey and Wright. His most important book was the monograph on "Parenchymatous keratitis," which was awarded the Gifford Edmonds Prize, and published by the "British Journal of Ophthalmology," as the first of its series of monographs. He had always been greatly interested in diseases of the cornea, and his monograph and case notes were profusely illustrated by original sketches. To the "Ophthalmic Review" he contributed important original papers on "Keratitis profunda" and "Nodular keratitis." He reported on an early case of pseudo-optic neuritis, recognizing that it was anomalous and not inflammatory in nature.

Sir John Parsons writes to "The Lancet": "He was widely read in literature and history, and endowed with unusual artistic ability and outlook. Coming early under the influence of the most scientific teacher of his time, Edward Nettleship, any high flights of imagination and originality, of which he was fully capable, were coordinated and controlled by that stern, but salutary, taskmaster." After retiring from practice and his hospital connections, Spicer devoted himself largely to sketching and pictures in water colors. He was refined and companionable. "His general presence, his keen sense of humor, and his inimitable reproduction of patients' tales, combined to render an evening memorable."

Edward Jackson.

Hugh Walker

Dr. Hugh Walker, a prominent ophthalmic surgeon at Glasgow, Scotland, died August 9, in his seventieth year. His father was a doctor who carried on a rural practice for nearly sixty years, and his younger son is still in practice at the same place. Dr. Hugh Walker was educated at the University of Glasgow, and at the University of Edinburgh, where he took the M.B. degree with honors, and the Beany Prize in anatomy and surgery. At Berlin he studied with Professor Greeff, and he translated into English Greeff's "Guide to the microscopic examination of the eye." In 1903 he became Surgeon to the Ophthalmic Department of the Victoria Infirmary. He was greatly interested in the eyes of school children, and was Ophthalmic Surgeon to the Glasgow School Board. During the World War he was stationed in Serbia, and for his services received the Order of St. Sava.

Edward Jackson.

CORRESPONDENCE

On the Relation between Accommodation and Convergence

Editor, American Journal of Ophthalmology:

Drs. Ludvigh and Pascal differ with me in interpretation of the data which I have presented. Each of them bases his difference of opinion with me on the fact that the visual axes assume a certain position in space when fixing a near object through prisms. This calculated angle of divergence of the visual axes is not actually greater for near than when an object 5 mm. away is fixed. However, the divergence relative to the position of convergence necessary for near vision is the significant value in this problem. The eyes assume the position in order to attain binocular single vision which is the fundamental factor in the regulation of the position of the optical axes. The position is attained by a quantitative balance of convergence and divergence. If we investigate any other impulse which may be stimulating or inhibiting to divergence or convergence, we must measure the change from the position produced by the impulse to binocular single vision. That this change in the position of the axes is proportionate to the accommodation is shown by the graphs.

F. H. Haessler.

August 12, 1935.

ABSTRACT DEPARTMENT

EDITED BY DR. WILLIAM H. CRISP

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is only mentioned in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. General methods of diagnosis
2. Therapeutics and operations
3. Physiologic optics, refraction, and color vision
4. Ocular movements
5. Conjunctiva
6. Cornea and sclera
7. Uveal tract, sympathetic disease, and aqueous humor
8. Glaucoma and ocular tension
9. Crystalline lens
10. Retina and vitreous
11. Optic nerve and toxic amblyopias
12. Visual tracts and centers
13. Eyeball and orbit
14. Eyelids and lacrimal apparatus
15. Tumors
16. Injuries
17. Systemic diseases and parasites
18. Hygiene, sociology, education, and history
19. Anatomy and embryology

---

1. GENERAL METHODS OF DIAGNOSIS

Blessig, E. **Remarks on photophobia.** Zeit. f. Augenh., 1935, v. 86, May, p. 108.

Blessig distinguishes three kinds of photophobia. (1) Simple, painless photophobia reduces visual acuity because of illumination of the retina. (2) Painful photophobia, seen in iritis, is largely due to hyperemia of the iris. (3) In blepharospasm with phlyctenulosis, other trigeminal pain stimuli contribute to the symptom.

F. Herbert Haessler.

Dejean, C., and Camboulives. **The disclosure of latent ocular tuberculosis by the Hollande agglutination reaction.** Arch. d'Opht., 1935, v. 52, April, p. 258.

Utilizing the agglutination reaction which the Hollandes described in 1933, and the technique of which they detail, the authors report their experiences with ten cases of myopic choroiditis (6 positive), two cases of uveitis (2 positive), 3 of recurrent hemorrhage into the vitreous (2 positive) and one case of thrombosis of the central vein (Hollande test negative). They believe that this test affords important information in latent or nonapparent tuberculosis, where other serologic reactions are at fault; especially as to a number of diseases of the ocular fundus the etiology and therapy of which are still uncertain. (Bibliography.) Derrick Vail.

Levkoeva, E. **Rapid embedding of eyes in celloidin.** Sovietskii Viestnik Opht., 1935, v. 6, pt. 3, p. 403.

The author discusses the technique for imbedding eyes in celloidin.

Ray K. Daily.

Lijo Pavia, J. **Green fundus patches; the first five observations.** Rev. Oto-Neuro-Oft., 1935, v. 10, May, p. 117. **The sixth observation.** The same, June, p. 143.

The green patches can be seen with the ophthalmoscope as well as recorded in color photographs of the fundus. The green patch must not be confused with the greenish color seen in the fundus under various conditions. A greenish color is imparted to a color photograph when a filter is used, and the latter should not be employed. There is a greenish zone in the following conditions: around white spots; near the retinal hole in retinal detachment; in the neighborhood of proliferating retinitis; around foreign bodies in the retina; near retinal reflexes; in retinitis pigmentosa; around the papilla in chronic sinusitis, anterior segment tuberculous

disease, and periphlebitis; in the papilla itself in glaucoma; in large sectors in Berlin's edema, cystic exudates, and subretinal tumors; in the Fuchs spot in myopia; and in the choroidal intervascular spaces. The green patch can be proved not to be an optical artefact. It is not due to blood, being absent in preretinal hemorrhages. On the basis of the five cases observed, the author believes the green patches represent the presence of serum in the tissues and oxidation of its bilirubin into biliverdin. Recognition in the color photograph of a lesion not visible in the black and white fundus picture indicates that it is situated in the choroid and is the result of angiospasm. The second communication deals with a case in a young man of thirty-five years. M. Davidson.

Lijo Pavia, J. **Photography of the slitlamp beam in the living human eye.** Rev. Oto-Neuro-Oft., 1935, v. 10, March, p. 62.

Further progress is reported by illustrations and the advantages of a record of slitlamp observations are stressed. M. Davidson.

McLean, A. J. **Cystoid bodies.** Arch. of Ophth., 1935, v. 13, March, pp. 391-403.

Cystoid bodies should not be used as a differentiation of special tissues, as they are the product of degeneration. The same changes are found in various tissues throughout the body, and commonly result from hyaline inspissation of coalesced sequestrated erythrocytes in interstitial spaces. (Photomicrographs.) J. Hewitt Judd.

Pillat, A. **Fundus findings in acute polyarthritis.** Wien. klin. Woch., 1935, v. 48, March 8, pp. 302-305.

In 60.7 percent of patients with acute polyarthritis a choroiditis was found. Four distinct types of lesion could be distinguished: (1) small old isolated peripheral lesions in one or both eyes; (2) groups or rows of small old lesions in the fundus periphery; (3) fresh choroiditic lesions; (4) disseminated miliary choroiditis. Discussing the differential diagnosis of syphilitic, nonspecific metastatic, and tuberculous lesions, the author gives preference to assumption of the tuberculous nature of these lesions, as no other known organism produces such a variety in appearance of the fundus picture.

Bertha Klien Moncreiff.

Poos, F. **Apparent reflex immobility (pupillotony) as diagnostic difficulty in accident evaluation of an injury of the spinal cord.** Klin. M. f. Augenh., 1935, v. 94, May, p. 676.

In a case of complicated injury of the spine the diagnostic evaluation of pupillary reflex disturbances played an important part in the reports of different examiners. The condition of the eyes had not changed within six years, and neither reflex immobility nor an affection of the optic nerve had developed. Contrary to former reports the neurologic symptoms were not attributable to lues. A transverse lesion of the spinal cord had been overlooked.

C. Zimmermann.

Scheerer, R. **Blanks for recording genealogic trees.** Klin. M. f. Augenh., 1935, v. 94, May, p. 682. (Ill.)

The blanks have horizontal lines and small circles, which can be traced and marked in the individual cases.

C. Zimmermann.

Tiedtke, H. **A simple registration apparatus for the black cloth chart of Birch-Hirschfeld.** Klin. M. f. Augenh., 1935, v. 94, May, p. 683. (Ill.)

A perimetric chart with recording device is described and illustrated.

C. Zimmermann.

Wiegersma, G. **The use and gauging of Weve's ballistometer.** Arch. f. Augenh., 1935, v. 109, April, p. 79.

The author made a slight improvement in Weve's ballistometer. The essential thing in a ballistometer is a hammer, balanced by a counterweight, which hits upon a more or less elastic body. While an elastic body repels the hammer with equal speed, and a semielastic body in proportion to its elasticity, a nonelastic body will not repel it at all. The author determined the im-

pact quotient for the cornea as 0.52. The tonometer and the ballistometer give equal readings for changes in tension, but different ones for changes in rigidity of the wall. With increase of rigidity the tonometer values rise and the ballistometer values fall. Comparison of the two values furnishes a numerical estimation of the rigidity of the cornea. R. Grunfeld.

2. THERAPEUTICS AND OPERATIONS

Atkinson, W. S. **Local anesthesia in ophthalmology.** Trans. Amer. Ophth. Soc., 1934, v. 32, pp. 399-451.

In a very comprehensive review the author discusses the history of local anesthesia, the various agents used, and the technique of nerve block, field block, infiltration, and retrobulbar injection. C. Allen Dickey.

Blidstein-Nevoroshkin, H., and Nevoroshkin, **I. Experimental data on the effect of roentgen rays on acute inflammatory diseases of the eye.** Sovietskii Viestnik Opht., 1935, v. 6, pt. 3, p. 339.

The eyes of guinea pigs were artificially infected with pneumococcus, staphylococcus, small-pox virus, and bacillus pyocyaneus. The eyes were exposed to from 15 to 20 percent skin erythema dose, 170 kv., 4 ma., 0.5 Cu plus 3 Al filter, some the day before infection, some immediately afterward, and others one or two days later. The results show that preliminary irradiation did not prevent development of infection, and that the reactions to x-rays of acute infections caused by the various microorganisms vary. The x-rays had no effect on infections due to Bacillus pyocyaneus and virulent streptococcus. The course of the disease and the final result of pneumococcus and small-pox infections were influenced favorably. Irradiation one or two days after infection was just as effective as irradiation immediately after introduction of the infectious material. The author concludes that the inconstant effect of a therapeutic dose is due to difference in microbic virulence, to difference in tissue reaction, and also perhaps to the fact that the optimum dose for the various microorganisms has not as yet been established. Ray K. Daily.

Clark, C. P. **The effect of malaria upon certain syphilitic conditions of the eye.** Trans. Amer. Ophth. Soc., 1934, v. 32, pp. 452-484.

On the basis of sixty case reports the author studied visual acuity, fundus field changes, and so on, and discusses the mechanism and technique of malaria treatment. If instituted before gliosis has developed, malaria may arrest luetic invasion of the optic nerves. The mechanism depends upon the response obtained from the reticulo-endothelial system. C. Allen Dickey.

Duggan, J. **Treatment of external eye diseases with ultraviolet light.** Proc. All-India Ophth. Soc., 1933, v. 3, p. 162. (See Amer. Jour. Ophth., 1934, v. 17, Oct., p. 974.)

Fahim, Fayek. **An unusual case of idiosyncrasy to yellow oxide of mercury and zinc sulphate ointments.** Bull. Ophth. Soc. of Egypt, 1934, v. 27, p. 90.

Dermatitis and edema of the lids and face developed after yellow oxide of mercury ointment was used in the treatment of corneal nebulae. The same patient had a diplobacillary blepharitis for which zinc sulphate ointment was prescribed, and a very severe reaction resembling erysipelas followed its use. Edna M. Reynolds.

Fradkin, M., Levina, L., and others. **Lysozyme in ocular infections.** Sovietskii Viestnik Opht., 1935, v. 6, pt. 3, p. 383.

Fifty patients with ulcer of the cornea, glaucomatous keratitis, or postoperative infection were treated with lysozyme applied with tampons every two hours, and instilled into the conjunctival sac every thirty minutes. The results show lysozyme as a powerful bactericidal agent, particularly effective in early cases, and in those with extensive necrosis of tissue, permitting free access to the infective agent. It is less effective in deep infiltrated ulcers, because it is absorbed by the superficial layers. Ray K. Daily.

Gomez Marquez. **The practical treatment of ocular tuberculosis.** Arch. Oft. Hisp.-Amer., 1935, v. 35, April, pp. 177-194.

The author discusses briefly the present knowledge of tuberculosis, especially as to allergy and immunity. As to the iris four conditions may occur: (1) very high immunity with (A) high allergy—acute iritis with frank cure, (B) low allergy—mild iritis with frank cure; (2) low immunity with (A) high allergy—acute iritis followed by tuberculosis of the iris, (B) low allergy—mild iritis followed by tuberculosis of the iris. Once the case is analyzed the treatment can be directed either to destruction of the bacilli or to modification of the allergic reaction, which according to the author is responsible for most of the pathologic changes produced by tuberculosis in the visual apparatus. For directly attacking the bacilli sanocrysin is recommended. Tuberculin is used to modify the allergic reaction. R. Castroviejo.

Laszlo, Giorgio. **An appraisement of the different syphilitic reactions in ophthalmology.** Ann. di Ottal., 1935, v. 63, May, p. 384.

In 2,469 cases, including a wide range of eye diseases, the Kahn, the Kiss, and the Meinicke precipitation test were compared with the Wassermann. In 2,403 instances the results were identical, in 66 they differed. In cases of recent syphilis the Wassermann was positive and the precipitation tests negative, whereas in the late cases or in the metasyphilides the Wassermann was negative and the precipitation tests were positive. The reasons for this are discussed. The fact is valuable in acquired syphilis. In hereditary syphilis there is no regularity, and a child with negative Wassermann at 4 to 5 years may be strongly positive at 11 to 12 years. In the late stage of syphilis or metasyphilis with Wassermann positive the indication is for combination of bismuth arsenobenzol and mercury, while when only the precipitation test is positive the iodides will be of more value than the heavy metals.

Park Lewis.

Law, F. W. **A new radiation lamp for local therapy.** Brit. Jour. Ophth., 1935, v. 19, June. p. 305.

The author offers his lamp as an efficient low-priced instrument. It consists of a mercury-vapor lamp and a quartz optical system. (Three illustrations.) D. F. Harbridge.

Lemoine, A. N. **Ocular manifestations of congenital syphilis and treatment by induced hyperpyrexia.** Trans. Amer. Ophth. Soc., 1934, v. 32, pp. 522-554.

Of 262 cases of congenital lues forty-one percent had ocular manifestations. The various ocular lesions are discussed, most frequent being a thin film covering the crypts of the iris. Twenty-two cases of interstitial keratitis treated with malaria are included, but fever treatment with hot baths was found equally efficacious.

A. Allen Dickey.

Leoz, G. **Fundamental treatment of ocular tuberculosis.** Arch. de Oft. Hisp.-Amer., 1935, v. 35, May, pp. 230-269.

This long article does not lend itself to review. In the first part the author discusses the present status of immunity, antigens, antibodies, allergy, and so on. In the second part he states at length his experience in treatment of ocular tuberculosis with tuberculin and with salts of gold. R. Castroviejo.

Migally, Amin. **On the use of saturated solution of magnesium sulphate in the treatment of acute inflammation of the conjunctiva and cornea.** Bull. Ophth. Soc. of Egypt, 1934, v. 27, p. 98.

In cases of acute conjunctivitis where the use of silver nitrate and milk injections are contraindicated because of extensive corneal ulceration, the continuous use of fifty percent magnesium-sulphate compresses is recommended. Magnesium sulphate is preferable to sodium chloride because it brings about dilatation of the local vessels, has an analgesic action, and is not easily absorbed. Edna M. Reynolds.

Montanelli, Gino. **Further studies on sulphur therapy in ocular diseases.** Lettura Oft., 1935, v. 12, Feb., p. 61.

Mild simple glaucoma with arterial hypertension, rheumatic iritis, postinfluenzal optic neuritis, and old nebular opacities of the cornea were treated with subcutaneous injections of iodized sulphur. In some of the cases arsenic was incorporated with the iodized sulphur. In the two glaucoma cases the tension and blood pressure were brought down to normal. (Pilocarpin was used in the eyes.) After the usual treatment had failed in the case of rheumatic iritis, considerable improvement was seen after five injections of the iodized sulphur, and complete cure after the eighteenth daily dose. Good results were also obtained in the other cases. Sulphur is considered efficacious primarily in its own right and secondarily by reinforcement and activation of other therapeutic agents.

F. M. Crage.

Neumann, J. **Dermitrine—a new base for ophthalmic ointments.** Klinika Oczna, 1935, v. 13, pt. 1, p. 109.

Dermitrine, composed of cholesterol and hydrocarbons, is a brownish, odorless, neutral mass, of the consistency of an ointment. It may be used as a base for all ophthalmic ointments. It clings well and is soothing to the cornea, and is free from the irritating substances so frequently found in vaselin and lanolin.

Ray K. Daily.

Neuschuler, I. **A new conjunctival irrigator.** Rassegna Ital. d'Ottal., 1935, v. 4, March-April, p. 218.

This instrument, designed for irrigating and applying medication to the conjunctiva, especially of the fornices, consists of a metal bowl-shaped portion, 22 by 19 mm., with a series of small openings at the edges and a perpendicular tube arising from the center of the bowl. The instrument is fitted into a soft rubber tube attached to a bag which holds the solution. The pressure of the fluid is varied by raising or lowering the container. After anesthetizing the eye the instrument is inserted between the lids and any desired solution employed to cleanse or treat the conjunctiva. (1 figure.)

Eugene M. Blake.

Popovichenko, I. **The significance of the Mantoux reaction.** Sovietskii Viestnik Opht., 1935, v. 6, pt. 3, p. 377.

Experience in one hundred patients with tuberculous eye diseases and in fifty control patients with nontuberculous eye lesions leads the author to conclude that repeated Mantoux reactions serve to determine the advisability of tuberculin therapy and to indicate dosage and prognosis. Ray K. Daily.

Sen, K. **Asepsis of the conjunctival sac in intraocular operations.** Proc. All-India Ophth. Soc., 1933, v. 3, pp. 126-133.

The author deprecates the use of mercury bichloride irrigations of the conjunctival sac preliminary to intraocular operations, having proved bacteriologically that the counted colonies increased in every case forty-eight hours after such irrigation. He prefers 1 to 10,000 mercury oxycyanide wash twice daily, one percent mercurochrome twice daily, and 0.5 percent ointment of yellow oxide of mercury to the lid margins at bedtime two days before operation. Nineteen cases so treated were all sterile, though nine cases had shown staphylococcus, streptococcus, or mixed organisms before treatment began. When the patient is on the operating table Sen allows one drop of two percent mercurochrome to remain in the conjunctival sac one minute, and then irrigates with sterile physiologic salt solution until the red color disappears. He advises hexylresorcinol solution S.T. 37 once daily for three days for B. pyocyaneus infection. Lawrence G. Dunlap.

Szaloczy, K., and Marjoros, J. **Pantocaine in ophthalmology.** Zeit. f. Augenh., 1935, v. 86, June, p. 220.

The authors recommend pantocaine for surface anesthesia. It is rapidly effective in the superficial tissues, the pupil is only slightly (if at all) dilated, the lid slit is not widened, tension is not affected, and the 0.5 percent solution

which is equivalent to a five percent solution of cocaine costs one-tenth as much. F. Herbert Haessler.

Tovbin, B., Gorodiskaia, G., and Drobova, G. **The effect of carotin on the chemistry of the eye.** Sovietskii Viestnik Opht., 1935, v. 6, pt. 3, p. 344.

The right eye of a guinea pig was operated on, and two or three drops of carotin instilled immediately after the operation and on each of four consecutive days. On the right eye of the control guinea pig the same operation was performed but no carotin was used. On the fifth day both guinea pigs were killed, the eyes enucleated, and the aqueous and vitreous of the operated and unoperated eyes examined for nitrogen and sugar content, and for degree of glycolysis. The study was repeated on ten operated and ten unoperated eyes. The tabulated report shows that instillation of carotin lowers the postoperative rise in the sugar content of the aqueous humor, intensifies glycolysis, and raises the nitrogen content of the aqueous and vitreous. It is evident from the tables that the changes in the chemical processes caused by the surgical traumatism and the instillation of carotin were found also to some degree in the animal's other eye.
Ray K. Daily.

Vila Ortiz, J. M., Jr. **Anesthetic value in ophthalmology of the percaine formulas of Maxwell Bochner.** Arch. de Oft. Hisp.-Amer., 1935, v. 35, April, pp. 172-176.

The author has found that cocaine as a local anesthetic in ophthalmology can be replaced by percaine, because the latter has almost all the advantages and few of the disadvantages of the former.
R. Castroviejo.

3. PHYSIOLOGIC OPTICS, REFRACTION, AND COLOR VISION

Alaerts. **A new theory on depth perception. The priority of peripheral points of the retina.** Arch. d'Opht., 1935, v. 52, May, p. 320.

After analyzing and discussing the various factors which make up depth perception the author states the following conclusions: (1) The essential factor in depth perception is the periphery of the retina (visual field). The maculae serves as landmarks. (2) The nasal part of the retina gives the impression of distance, the temporal part that of near. (3) There is always a comparison by superposition of the two retinas. (4) The part of the retina where the visual impression is most centrifugal gives the sense of depth; demonstrating the priority of the peripheral point.
Derrick Vail.

Banerjee, J. **School myopia.** Proc. All-India Ophth. Soc., 1933, v. 3, pp. 168-172.

Out of 1,584 students in schools and colleges in Calcutta 487 (35 percent) were myopes or myopic astigmatics. Myopia was slightly more prevalent among female than among male students. Lawrence G. Dunlap.

Bergmeister, Rudolph. **The limits of visibility of the spectrum.** Zeit. f. Augenh., 1935, v. 86, May, p. 98.

The author corroborates Knapp's observation that ultraviolet light is visible to an aphakic eye. A professor of astronomy who was operated on for cataract by Bergmeister was able to see clearly the iron line group (310) in a grating spectrograph and was aware of light at a wave length of 290. In a normal eye, light of so short a wave length does not reach the retina.
F. Herbert Haessler.

Bücklers, Max. **Observations on the course and involution of the tunica vasculosa lentis in new-born Java macacus monkeys.** Graefe's Arch., 1935, v. 134, p. 48.

In fifteen new-born Java macacus monkeys studied, in the Tübingen Zoological Institute, the tunica vasculosa lentis was more or less present at birth. The pupillary membrane was still frequently represented by a vascular rim to the iris, containing blood. The branching of the hyaloid artery (capsular membrane) was always visible, and a hyaloid canal was present. The duration of postnatal involution varied between one and four weeks.
H. D. Lamb.

Eaves, E. C. **Observations on color vision in students.** Trans. Ophth. Soc. United Kingdom, 1934, v. 54, p. 603.

The author found color blindness in about eight percent of men students and no instance among women students. Severely color-blind individuals may pass a naming or a matching test, but not usually both. The reaction times for red and green lights are not necessarily initially longer than for white light, but are more inconstant and there is early onset of fatigue. Beulah Cushman.

Fahim, Fayek. **A case of high myopia with description of some details.** Bull. Ophth. Soc. of Egypt, 1934, v. 27, p. 76.

In a patient aged forty years the refractive correction of the right eye was —44 diopters and that of the left eye —30 diopters. The vision of the right eye with correction was 4/60, that of the left eye 6/60. Both lenses showed sclerosis but no opacity. The lenses were in normal position and there were no vitreous opacities. There was diffuse atrophy of both choroid and retina. The discs had no temporal crescents. No detachment of either retina was made out. A deep posterior staphyloma was seen in each eye. The author considers the case one of axial myopia complicated by a refractive myopia from sclerosis of the lens nucleus. Edna M. Reynolds.

Fontana, G. **Glycogen in the retina of vertebrates in normal and experimental conditions.** Rassegna Ital. d'Ottal., 1935, v. 4, Mar.-Apr., p. 135.

The author studied the behavior of glycogen in normal and experimental conditions in frogs and rabbits, using the histochemical methods suggested by Best and Langhans. In these animals one finds granules of glycogen in the pigmented epithelium, in the layer of rods and cones, and in the external limiting membrane. The condition of the pigment epithelium varies according to whether the animal has been kept in the dark or exposed to intense direct light. The glycogen is lacking in the former and abundant in the latter condition. In conditions of experimental hypoglycemia or hyperglycemia, glycogen is found diffusely in all layers of the retina. The author's results by the methods of Best and Langhans were similar to those he previously reported with the Fischer technique. Eugene M. Blake.

Henderson, Thomson. **The constitutional factor in myopia.** Trans. Ophth. Soc. United Kingdom, 1934, v. 54, p. 451.

The author describes myopia as a constitutional condition produced by inadequacy of the scleral tissue, with diminished power of resistance to normal strain. He argues that accommodation and convergence have no influence on the pressure of the eye, for if they did excavation of the optic nerve would occur and this never happens in myopia. Beulah Cushman.

Hughes, W. L. **Aniseikonia.** Amer. Jour. Ophth., 1935, v. 18, July, pp. 607-615; also, **Some clinical observations on aniseikonia.** Amer. Jour. Ophth., 1935, v. 18, Aug., pp. 715-719.

Karbowski, M. **Phenomena of color-vision: contrast and irradiation.** Klinika Oczna, 1935, v. 13, p.t 1, p. 80.

In opposition to Tschermak's theory the author attributes these phenomena to propagation of light energy in the retinal neurons, and assigns an important part to the horizontal cells of the retina. (See also Amer. Jour. Ophth., 1935, v. 18, Aug., p. 777. Ray K. Daily.

Kissin, P. **Artificial daylight in testing with the pseudoisochromatic tables of Ishihara.** Graefe's Arch., 1935, v. 134, p. 38. (See Amer. Jour. Ophth., 1935, v. 18, June, p. 577, and August, p. 777.)

McAndrews, L. F. **Ocular dominance.** Arch. of Ophth., 1935, v. 13, March, pp. 449-455.

A review of the literature indicates that the majority have a dominant eye, and in more than eighty percent this is the right eye. A direct relationship exists between the eye and the hand. In testing, the Maddox rod should be placed before the nondominant eye, and prisms in glasses are best tolerated by this eye. J. Hewitt Judd.

Medrano, I. R. **Hysterical paralysis of the nuclear aspect of the third and seventh cranial nerves.** Arch. de Oft. Hisp.-Amer., 1935, v. 35, March, pp. 139-144.

In a case with sudden loss of vision in one eye, pain, and paralysis of the third and seventh nerves, complete recovery took place three days after onset. The author points out the diagnostic difficulties of some hysterical manifestations closely resembling syndromes produced by anatomo-pathologic changes.

R. Castroviejo.

Nicolai, C. **The mechanism of accommodation, a new theory.** Klin. M. f. Augenh., 1935, v. 94, May, p. 617. (Ill.)

Nicolai's investigations led him to distinguish three muscles in the human ciliary body: the meridional, which he calls tensor chorioideae, the radial at the inner side of the ciliary body, and the circular bundle. Accommodation must be under the influence of two muscles, radial and circular, both exerting considerable pressure on the vitreous, which presses against zonula and the periphery of the lens. The zonula being relaxed, the lens becomes thicker and acquires higher refraction and the anterior chamber grows larger at the periphery.

C. Zimmermann.

Pflugk, Albert. **Newer methods in investigation of the theory of accommodation.** Supplement to communication 5. Graefe's Arch., 1935, v. 134, p. 118.

The experiment described was applied to a normal human eye, enucleated thirty minutes after sudden death from accident. A window was made through sclera, choroid, and retina in the region of the equator. When a drop of 0.5 percent fluorescein solution was injected from a tuberculin syringe through this window into the region between the ciliary body and the equator of the lens, and pressure was exerted upon the ciliary region, the colored solution always moved toward the posterior pole of the lens.

H. D. Lamb.

Roaf. H. E. **Color vision.** Trans. Ophth. Soc. United Kingdom, 1934, v. 54, p. 604.

The author reviews theories and diagnostic methods. He concludes that congenital defect in color vision is due to diminished ability to distinguish red from not red, whereas the subject can distinguish blue from not blue. Night blindness is accompanied by blue blindness, and there is a certain amount of evidence that rods are the receptors which give rise to blue or violet sensation.

Beulah Cushman.

Smith, F. W. G. **Three simple aids in refraction work.** Brit. Jour. Ophth., 1935, v. 19, July, p. 407.

The first is a pair of finger clips upon which are mounted one plus and the other minus 0.25 and 0.50 D. sphere. The clips fit on the proximal phalanges of the middle and little fingers of the left hand, for bringing the lenses against the glass in the trial frame. A children's distant test type is made of two pieces of strong cardboard 30 by 24 inches hinged together and with folding side pieces. When one of the cards is exposed the other is out of sight of the child. For examination of patients confined to bed the author places a mirror on a music stand which is anchored by weights, to afford proper height and inclination for the reversed method when distance is limited.

D. F. Harbridge.

Sorsby, Arnold. **The premyopic state.** Trans. Ophth. Soc. United Kingdom, 1934, v. 54, p. 459.

The literature is reviewed to show that axial elongation of the eyeball is not always found in myopia. In a study of 1,444 Jewish and non-Jewish children, the author found slightly more myopia among the Jewish children.

Beulah Cushman.

Tschermak-Seysenegg, Armin. **Spectral distribution of saturation; and gauging the spectrum with three lights.** Arch. f. Augenh., 1935, v. 109, April, p. 1.

As a normal trichromat is unable to match satisfactorily a given color of the spectrum, its shade, and its luminosity with the three primary colors unless white light is mixed with them, so, the

author contends, a dichromat will match a given color to his utmost satisfaction only when he adds to the two optimum saturated primary colors a third light, the colorless wave length, which lies for the deuteranope at 505 millimicrons, and for the protanope at 495 millimicrons. For this purpose the author determines the colorless spot, the neutral point, for the individual dichromat, and with the aid of this colorless light the optimum saturation of two primary colors at the extreme end of the spectrum. The author uses his own modification of Helmholtz' mixing apparatus for spectral light. Determination of the neutral point serves to differentiate the deuteranope from the protanope. The results with the three lights confirm Hering's color theory. R. Grunfeld.

Vishnevskii, H., and Zirlin, B. **The relation of dark adaptation to the preceding intensity of illumination.** Sovietskii Viestnik Opht., 1935, v. 6, pt. 3, p. 320.

The authors studied the effect of exposure to intense illumination, and the effect on dark adaptation of prolonged reduction in illumination obtained by wearing dark lenses. Tables and graphs show that dark adaptation is closely related to preceding light adaptation. Exposure to one thousand light candles is followed by lower light sensitivity than exposure to moderate light, such as two hundred light candles. Light sensitivity may be increased by short monocular or binocular exposure to light of moderate intensity, or by prolonged wearing of filtering lenses. Monocular light exposure produces a brief rise in sensitivity followed by a gradual drop to normal. Binocular exposure causes an initial sharp drop in sensitivity, then a rise above normal and within several hours again a drop. Wearing of protective lenses causes a rise in sensitivity lasting not less than three hours. The most practical method of improving dark adaptation seems to be preliminary wearing of protective lenses.

Ray K. Daily.

4. OCULAR MOVEMENTS

Berens, C., and Payne, B. F., and Kern, D. **Orthoptic training and surgery in hyperphoria and hypertropia combined with lateral deviations.** Amer. Jour. Ophth., 1935, v. 18, June, pp. 508-524; also Trans. Amer. Ophth. Soc., 1934, v. 32, p. 245.

Bielschowsky, Alfred. **Lectures on motor anomalies of the eyes. 3. Paralyses of the conjugate movements of the eyes.** Arch. of Ophth., 1935, v. 13, April, pp. 569-583.

Associated paralysis of parallel lateral movements of the eyes is discussed. This anomaly occurs mostly in individuals having lesions of the associated pathways either within or near the pons and in the region of the fourth ventricle. Associated paralyses of vertical movements were found in the following order of frequency: 1, paralysis of the elevator muscle; 2, paralysis of the elevator and depressor; 3, paralysis of both elevators and depressors. The origin is supranuclear, as shown by Bell's phenomenon. Other types of associated paralysis are briefly reviewed, especially those due to disturbances in the extrapyramidal motor system, the corpus striatum, and the cerebral hemispheres. Convergent paralyses of organic origin are very rare. A subcortical center for convergence is assumed. The possibility of divergence paralysis is conceded.

J. Hewitt Judd.

Bielschowsky, Alfred. **Lectures on motor anomalies of the eyes. 4. Functional neuroses: etiology, prognosis and treatment of ocular paralysis.** Arch. of Ophth., 1935, v. 13, May, pp. 751-770.

Hysteria frequently results in spastic tropias, but true functional paralysis of an individual muscle or unilateral ophthalmoplegia has not been encountered. Unilateral, nonspastic, hysterical ptosis and hysterical associated paralyses must be carefully differentiated from those caused by incipient organic lesions. Ocular paralyses are discussed with special emphasis on operative treatment. The various procedures are

illustrated by case reports and photographs. J. Hewitt Judd.

Bruce, G. M. **Ocular divergence: its physiology and pathology.** Arch. of Ophth., 1935, v. 13, April, pp. 639-660.

Divergence and its antagonist convergence are assumed to appear on the phyletic scale simultaneously and to occupy an equally recent and high position. Divergence begins passively but soon becomes active and remains active during the greater part of the act. While this, therefore, is mostly an active process, it is not volitional. Anomalies of divergence fall into three groups: paralysis, divergence weakness, and divergence excess. Each of these groups is discussed as to etiology, symptomatology, and treatment. A center for divergence is assumed and is believed to lie in the mid line, separate from but adjacent to the nucleus of the sixth nerve. J. Hewitt Judd.

Chavasse, Bernard. **Thermoplasty of the extraocular muscles and posterior myotomy.** Trans. Ophth. Soc. United Kingdom, 1934, v. 54, p. 506.

Under general anesthesia a controlled dosage of diathermic current was applied to the belly of the dissected ocular muscle to produce "relaxing thermoplasty." The procedure was usually applied to the corresponding muscle of each eye to secure sufficient effect. The author has also used fulguration or the dehydrating effect of the diathermic current to minimize the unsightly effect of a tuck. (Twenty-eight case reports.) Beulah Cushman.

Feldman, J. B. **Orthoptic treatment of concomitant squint.** Arch. of Ophth., 1935, v. 13, March, pp. 419-434.

The author describes the methods used in his clinic and reports the first year's results in four tables. Group one consists of ten cures. Group two deals with fifteen patients showing improvement, but still under training. The eleven patients in group three show little improvement, but seven are obtaining fusion. In the fourth group of fourteen patients, eleven with alternating squint, treatment was discontinued. Unsuitable cases should be eliminated by using Braun's method of classification as to retinal incongruity.
J. Hewitt Judd.

Gamble, R. C. **The visual prognosis for children with congenital nystagmus.** Trans. Amer. Ophth. Soc., 1934, v. 32, pp. 485-496.

This is a statistical study of sixty-five cases of nystagmus not associated with conditions which of themselves lower vision (cataract, atrophy). The visual acuity, type of nystagmus, refractive error, and changes shown by later examination are summarized. Eighty percent could attend regular school classes, and twenty percent needed to be in sight-saving classes.
C. Allen Dickey.

Handmann, Wolfgang. **Anatomic contribution to periodic paresis of the oculomotor nerve.** Klin. M. f. Augenh., 1935, v. 94, May, p. 606.

A paretic of fifty-two years presented periodic paralysis of the left levator palpebrae (which later became permanent) and immobility of the pupil to light. As anatomic cause syphilitic changes, chiefly of the oral portion of the left large-celled lateral nucleus, were found. Probably recurring vasomotor fluctuations produced the primarily periodic paralysis.
C. Zimmermann.

Horváth, Béla. **Suture for resection of muscles.** Klin. M. f. Augenh., 1935, v. 94, May, p. 673. (Ill.)

The suture is described as easier and faster to apply. C. Zimmermann.

Kiewe, P. **Granuloma teleangiectaticum (pediculatum) of the ocular conjunctiva.** Klin. M. f. Augenh., 1935, v. 94, May, p. 614. (Ill.)

The granuloma developed after a squint operation. C. Zimmermann.

Majoros, Janos. **Rigor mortis of the eye muscles.** Graefe's Arch., 1935, v. 134, p. 112.

Rigor mortis occurs as a rule later in all the external eye muscles than in the musculature of the head and neck, but it ceases at the same time in both locations. The cause for the palpebral fissure remaining open (66 percent) is partly mechanical and partly rigor mortis of the closing muscle and of the lid elevator. Post-mortem divergent squint frequently occurs and has forensic significance. Its cause is probably an exophoria becoming manifest post mortem. The eyeballs are more frequently directed upward after death.
H. D. Lamb.

Marlow, F. W. **Muscle imbalance in myopia.** Arch. of Ophth., 1935, v. 13, April, pp. 584-597.

This report is based on study of two groups of fifty cases each; one group in which no selection was made as regards progressiveness or asthenopia, and the second presenting these characters. The data, presented in tables, show a very high percentage of cases of axial myopia as demonstrating muscle imbalance. This is regarded as a most important factor in the onset and progress of myopia. Occlusion tests carried out at an early stage revealed hyperexophoria in seventy percent. Six cases are reported in detail. J. Hewitt Judd.

Mayou, M. S. **Discussion on squint.** (President's address.) Trans. Ophth. Soc. United Kingdom, 1934, v. 54, p. 3.

The author reports the results of operation in 700 cases of the rarer forms of squint. Under local anesthesia he controls the result during operation by the Maddox rod test with a light set in the ceiling of the operating room over the head of the operating table. With tenotomy a correction of not more than fifteen degrees is obtained in the adult and twenty degrees in children. In an advancement the author usually tenotomizes the opposing muscle, at least temporarily, so as to prevent traction on the sutures. Tenotomy of the superior rectus usually corrects about ten to twelve degrees of hyperphoria. Various congenital and symptomatic defects are discussed. Beulah Cushman.

Nugent, O. B. **Recession operation with control suture.** Amer. Jour. Ophth., 1935, v. 18, Aug., pp. 744-751.

Ohm, J. **Contribution to the knowledge of nystagmus:** 37th communication. Graefe's Arch., 1935, v. 134, p. 27.

Although pendulum-like or jerking motions of the eyes with nystagmus usually occur successively in an entirely uniform manner, yet at times between the jerks in one direction are seen several motions in the opposite direction. If such opposing jerks occur frequently, so as to efface the basic character of the curve, the author speaks of zigzag motions. These occur under normal conditions in the light, although they are then usually small and infrequent. Among healthy persons they are much larger and more frequent in the dark. If zigzag movements occur with neurogenic nystagmus in light, they indicate a weakness in some part of the reflex arc. H. D. Lamb.

Paton, R. T. **Device for training of children to overcome strabismus.** Arch. of Ophth., 1935, v. 13, April, pp. 636-638.

This method attracts attention for long periods by allowing the child to build pictures of what he sees with small sticks. The Maddox cheiroscope is used together with cards in sets of two. One card shows a picture drawn in a series of straight lines. The other card is a stencil reproduction with some minor details left out. The child completes the picture with sticks cut in lengths corresponding to slots in the stencil. Another series has been devised using a punch board on a drawing platform. J. Hewitt Judd.

Walker, Charles. **Thermoplasty.** Trans. Ophth. Soc. United Kingdom, 1934, v. 54, p. 524.

Histologic findings following thermoplasty with diathermic electrocoagulation after operations on ocular muscles of rabbit eyes are given. There is degeneration of nerves and nerve endings in the treated muscle.
Beulah Cushman.

5. CONJUNCTIVA

Alvaro, E. **Pterygium and trachoma.** Rev. Internat. du Trachome, 1935, v. 12, Jan., pp. 32-33.

Previous authors record the infrequency of pterygium in trachoma. Out of 24,481 miscellaneous patients 5.1 percent had pterygium, while only 2.6 percent out of 3,656 who had trachoma had also pterygium. According to the author this infrequence may be due to the photophobia in trachoma which does not permit irritation of the conjunctiva and cornea by dust particles.

P. J. Leinfelder

Avizonis, P. **Pterygium and trachoma.** Rev. Internat. du Trachome, 1935, v. 12, April, p. 97.

The author finds pterygium occurs more frequently (1 percent) in trachomatous eyes than in nontrachomatous eyes (0.3 percent).

P. J. Leinfelder.

Balbuena, Fernandez. **Three cases of septicemia following pneumococcic conjunctivitis.** Arch. Oft. Hisp.-Amer., 1935, v. 35, April, pp. 169-172.

The author reports three cases, one in a woman thirty years old, and the other two in children from one to two years of age. Twenty-four hours after onset in the conjunctiva the lymphatics and glands of face and neck were already invaded by the pneumococci. Shortly afterward the germ could be isolated in the blood. The woman completely recovered, but death occurred in the other two cases. (Photograph.)

R. Castroviejo.

Banaji, B. P. **A case of spring catarrh successfully treated by injection of emulsion of "proteose" from the urine.** Proc. All-India Ophth. Soc., 1933, v. 3, pp. 109-112.

To overcome the difficulty of finding the particular allergen causing an allergic manifestation, which the author considers spring catarrh to be, he used the Oriel method whereby the allergen can be collected in the form of proteose from the urine. After all other methods of treatment such as radium and milk injections had failed, intradermal proteose injections fortnightly for seven doses cured the patient, and there was no relapse in the following three years.

Lawrence G. Dunlap.

Biffis, Andrea. **A case of plasmocellular conjunctivitis in a subject affected with the bronchospirochete of Castillani.** Ann. di Ottal., 1935, v. 63, May, p. 341.

The subject of this study had suffered from icterus in Argentina, and for fifteen or twenty days from periodic afternoon fever from which he had recovered. For the past three years he had had bloody sputum and difficult respiration. An indolent tumefaction developed in the left upper lid, producing entropion. The diagnosis was possible only through histologic study. Plasmocellular conjunctivitis does not permit of pathognomic differentiation from the vegetative type of conjunctivitis. (Colored plate, bibliography.)

Park Lewis.

Bruck, A. **A contribution to the classification of trachoma.** Rev. Internat. du Trachome, 1935, v. 12, Jan., pp. 24-32.

The author reviews the various diagnostic points in trachoma and follicular conjunctivitis, and he suggests including follicular conjunctivitis as a subgroup of type 1, abortive and initial trachoma. He considers the differentiation of the various classes of trachoma and advocates more specific nomenclature, for example type 2 (with pannus), type 3-4 (indicating the stage between progressive and cicatricial trachoma).

P. J. Leinfelder,

Busacca, Archimede. **New results in experimental pathology of trachoma.** Folia Clinica et Biologica, 1935, v. 7, no. 2, pp. 58-62.

The author asserts his priority in successful inoculation of trachomatous tissue into the vitreous of animals.

Busacca, Archimede. **The presence of trachomatous tissues of a virus resistant to glycerin and transmissible serially to animals.** Folia Clinica et Biologica, 1935, v. 7, no. 2, pp. 63-65.

The experiments were made with materials kept in glycerin for sixteen days. Inoculation of this material into vitreous of the hen and the rabbit (after washing completely free from glycerin) gave rise to severe uveitis, conjunctivitis, and more rarely keratitis, with formation of nodules. The infection was transmitted through animal series. Rubbing of conjunctival material showed germs with the characteristics of the rickettsias described in man.

W. H. Crisp.

Chakravarti, B. **Epidemic monocular conjunctivitis.** Proc. All-India Ophth. Soc., 1933, v. 3, pp. 95-101.

The author reports 327 cases seen in four years, and occurring exclusively in the rainy season and autumn. The clinical symptoms and appearance are typical of Parinaud's conjunctivitis except that conjunctival granulations are absent. The infection cannot be transmitted to the healthy eye. Corneal involvement occurred in eighty-three percent of the cases, as minute dot-like infiltrations, rarely deeper than the superficial epithelial layers. One to fifty crater-like staining spots are observed in each case. The preauricular gland on the involved side is enlarged. The course of the disease is two to three weeks, but symptoms last only five to ten days under treatment.

Lawrence G. Dunlap.

Cohen, M., and Sulzberger, M. B. **Essential shrinkage of the conjunctiva in a case of probable epidermolysis bullosa dystrophica.** Arch. of Ophth., 1935, v. 13, March, pp. 374-490; also Trans. Amer. Ophth. Soc., 1934, v. 32, p. 50.

This rare condition was found in a boy seven years old, and was confirmed by histologic examination of the skin and of the right eye, which was enucleated after a necrotic ulcer had perforated. Both the skin and conjunctiva showed a tendency to fissure formation between the epithelium and the connective tissue, as well as to absence or diminution of elastic tissue fibers. The treatment is inadequate, but injection of neoarsphenamin is apparently beneficial. The article is well illustrated, and contains two colored plates.

J. Hewitt Judd.

Cuénod, A. **Preliminary note on the presence of intramicrobial elements in trachomatous follicles.** Arch. d'Opht., 1935, v. 52, March, p. 145.

The author does not believe that Noguchi's Bacterium granulosis plays the etiologic part assigned it by its discoverer. He discusses inclusion bodies in general, their morphology and staining qualities particularly. The presence of these bodies has been frequently demonstrated in trachoma but not specifically so. By the author's technique, which he describes, one will find alongside of these elements small protoplasmic particles of different forms and dimensions. These vary between 2 and 10 to 13 micra in diameter, are generally round or oval, appear as fine droplets with more or less serrated edges, and are usually a pale blue or lilac tint, in contrast to the rose-violet color of the cells which surround them. The first point to notice is the presence of dark dots in the cytoplasm. A second point is the regular swarming of infinitely small corpuscles, about 0.2 micra in size, in the free débris. The author believes that these bodies are most important as an etiologic factor. (Illustration.)

Derrick Vail.

Di Fede, Niccolo. **Vaccine therapy of trachoma.** Lettura Oft., 1934, v. 11, Nov.

In accordance with Czerny, Paltauff, Angelucci, and Brana, the author feels that trachoma should not be considered as resulting from some specific bacterium alone but from combination of a certain constitutional makeup and a bacterial agent. The vaccine used was a polyvalent mixture of an integral emulsion of fresh virulent cultures, obtained from the conjunctiva of trachomatous patients during the active stage. The cultures were inactivated and standardized to a count of 500 million per c.c. The vaccine was made isotonic and mildly antiseptic. It had no ulterior effect on living tissues. Subconjunctival injections of 0.2 to 0.5 c.c. were made in

the upper or lower fornix in the more severe cases on alternate days. Corneal ulcers received similar local treatment. Instillations of the vaccine were used in the milder cases, and vaccine ointment in the external forms (blepharitis). Prior to the vaccine treatment the acid state so prevalent in the trachomatous was overcome by alkaline therapy. Iodine and calcium were given to those requiring modification of lymphatic and adenoid states. Brief descriptions of ten cases are given. There was generally early healing without cicatrization.

F. M. Crage.

Erdös, E. **A case of aphthous conjunctivitis.** Klin. M. f. Augenh., 1935, v. 94, May, p. 656. (Ill.)

Five days previously sawdust got into the right eye, and a coworker had removed it with his tongue. After twenty-four hours both eyes became red and painful. On the third day about ten painful aphthae of the size of a lentil developed in the right half of the mouth. The palpebral conjunctiva presented a thick, well defined, white diphtheroid pseudomembrane, which contained polymorphonuclear leucocytes and a few epithelial cells, but no bacteria. Inoculation of the cornea of rabbits had no direct inflammatory effect, but after about seven days a diffuse conjunctivitis began, which showed no immunity against a subsequent inoculation of herpes. Hence the case could not be considered as an atypical herpes infection, but as aphthous conjunctivitis from a virus not connected with herpetic organisms. C. Zimmermann.

Gardilcic, A. **Experiments with a new trachoma therapy.** Zeit. f. Augenh., 1935, v. 86, May, p. 121.

The tears and the conjunctival secretion are usually acid in inflammation of the conjunctiva. On the assumption that the hypothetic etiologic agent might disappear if the reaction of the culture medium were changed to alkaline, and so the conjunctiva might heal, the author applied alkaline buffer solutions, but failed to achieve any cures. In a second series he applied oxidative agents to destroy the toxins, to stimulate phagocytosis, and to increase the development of immune bodies. He used peroxide of benzol and inorganic as well as organic chlorine, splitting compounds of sodium, potassium, calcium, magnesium, zinc, cobalt, mercury, silver, and gold, in drops and ointment. Benzol was worthless, chloramine was slightly beneficial, and sodium hypochloride and Dakin's solution were very effective. F. Herbert Haessler.

Guha, G. S. **Observations on the effect of chaulmoogra oil in the treatment of trachoma.** Proc. All-India Ophth. Soc., 1933, v. 3, pp. 102-103.

The author concludes that chaulmoogra oil is effective in the pure papillary variety of trachoma and that results are good in the follicular types, after expressing the follicles, if it is painted on the lids daily for a month or longer where there is deep scarring of the lids. In the older cases the oil is less effective. Lawrence G. Dunlap.

Koszutski, B. **Clinical observations.** Klinika Oczna, 1935, v. 13, pt. 1, p. 116.

Three unusual cases are reported: diphtheric conjunctivitis in the newborn; retrobulbar abscess with loss of vision after frost-bite of the lids; removal of shot from the anterior chamber, with preservation of the eyeball.

Ray K. Daily.

Koutseff, André. **The allergic noninfectious conjunctivitides.** Ann. d'Ocul. 1935, v. 172, June, pp. 473-492.

This is a discussion of the allergic state in general with particular reference to allergic diseases of the conjunctiva. The agents provoking allergic reactions include atmospheric dust, foods, drugs, agents which act by contact, parasites, and physical agents such as cold, heat and light. Various tests for hypersensitiveness are described. The conjunctiva may respond to allergins in one of two ways, either by an eczematous reaction with follicle formation or by the production of edema, the type depending upon the agent.

John C. Long.

Lamb, H. D. **The reticulum in the chronically hyperplastic conjunctiva.** Amer. Jour. Ophth., 1935, v. 18, Aug., pp. 724-729.

MacCallan. **Recent advances and principles of prophylaxis in trachoma.** Rev. Internat. du Trachome, 1935, v. 12, April, p. 53. (See Amer. Jour. Ophth., 1935, v. 18, Aug., p. 785.

MacCallan, A. F. **The trachoma problem.** Brit. Jour. Ophth., 1935, v. 19, July, p. 383.

MacCallan comments on Wright's article of the same title (abstracted in the present issue, see below). The Indian Health and Army report for 1931 states that over ninety percent of the Sikhs are infected. But the word trachoma is used loosely and not all cases are trachoma. Before treatment the diagnosis should be established by observation of early pannus vessels with the corneal loupe. An abstract of the international literature of the subject is about to be undertaken by Wilson of the Giza Memorial Laboratory in Egypt.

D. F. Harbridge.

Meyerhof, M. **Acute catarrhal conjunctivitis in Egypt.** Klin. M. f. Augenh., 1935, v. 94, May, p. 680.

Referring to Chronis' paper, Meyerhof states that Koch-Weeks conjunctivitis is very frequent in Egypt but only exceptionally affects the cornea and almost only in trachomatous eyes. Gonorrheal blennorrhea causes seventy percent of blindness in Egypt.

C. Zimmermann.

Motegi, A. **Contribution as to a kind of microorganism in trachomatous tissue.** Klin. M. f. Augenh., 1935, v. 94, May, p. 631.

The author continues his studies of the microorganisms previously reported. (See Amer. Jour. Ophth., 1933, v. 16, p. 750.) The sprouting form of the microorganism in the trachomatous fornix was found in 66.67 percent of sixty culture cases, and the bacillary form in 21.67 percent, but in trachomatous pannus the bacillary form was found alone in 17-71 percent of forty-five culture cases. The agglutination of these microorganisms is easily recognizable in the serum of trachoma patients and differs in the serum of other eye patients or healthy persons. Its value increases with the progress of the trachoma. It is specific for the sprouting form but not for the bacillary form. Hence the former is in more intimate relation to trachoma than the latter.

C. Zimmermann.

Mourzinn, N., and Souchkowa, G. **Lysozyme of tears in trachoma.** Rev. Internat. du Trachome, 1935, v. 12, Jan., pp. 1-15.

The authors review the information available concerning the concentration and activity of lysozyme in the lacrimal fluid. In phlyctenular disease, xerophthalmia, and conjunctivitis a diminished titer of the substance is found. In trachoma the lysozyme content of the tears was reduced, especially in the more acute stages. In trachomatous ulceration of the cornea this diminution was especially noted. (Bibliography.)

P. J. Leinfelder.

Pascheff, C. **The laws of trachoma.** Klin. M. f. Augenh., 1935, v. 94, May, p. 630; and Arch. d'Opht., 1935, v. 52, May, p. 301.

This paper closely resembles others previously published by the same author (see Amer. Jour. Ophth., v. 17, pp. 372 and 654).

Reed, P. H., and Mayer, L. L. **Bilateral temporal pterygia.** Amer. Jour. Ophth., 1935, v. 18, July, pp. 605-607.

Rice, C. E. **A note on the frequency of involvement of the anterior auricular lymph nodes in trachoma.** Amer. Jour. Ophth., 1935, v. 18, July, p. 651.

Ross, A. S., and Shipman, J. S. **Malignant anthrax edema.** Amer. Jour. Ophth., 1935, v. 18, July, pp. 641-644.

Sédan, Jean. **Three cases of seasonal trachoma.** Rev. Internat. du Trachome. 1935, v. 12, April, p. 91.

In three cases of trachoma there were acute seasonal exacerbations.

P. J. Leinfelder.

Selfa Martinez, E. **Inoculations of a filtrate of trachomatous granulations in a human conjunctiva previously blocked by colloid coloring agents.** Arch. de Oft. Hisp.-Amer., 1935, v. 35, March, pp. 121-126.

The author has experimented in his own eye to find out whether the etiologic agent of trachoma is a filterable virus. He first blocked the reticular-endothelial system of the conjunctiva by using subcutaneous injections of carmine red. Then injections and scarifications of the conjunctiva were made with a filtrate of trachomatous granulations. No trachomatous granules could be detected in the conjunctiva during the following weeks. Some congestion developed but disappeared entirely in twenty-one days. Observations were carefully made with slitlamp and corneal microscope. The author arrives at the conclusion that the etiologic agent of trachoma is not a filterable virus. R. Castroviejo.

Selinger, Elias. **Local quinine therapy in trachoma.** Amer. Jour. Ophth., 1935, v. 18, July, pp. 631-637.

Sokolnitzky, J. N. **The treatment of trachoma with ginger.** Rev. Internat. du Trachome. 1935, v. 12, Jan., pp. 34-41.

The author introduces into the conjunctival sac of his trachomatous patients a powder composed of one part of powdered ginger root to three parts of sugar. After five minutes the powder is washed out to remove small particles that might damage the cornea. The treatment is followed by severe irritation, which soon subsides and is followed by a sensation of relief. On the next day the patients ask for more powder. Blepharospasm, lacrimation, and photophobia disappear in two to three days. The treatment is especially valuable in cases with ulcerative pannus. The author has used the procedure for two and a half years. (Two case reports.) P. J. Leinfelder.

Talbot. **The only efficient prophylaxis against the social scourge of trachoma.** Rev. Internat. du Trachome, 1935, v. 12, Jan., pp. 15-24.

The most important patient to treat in decreasing the incidence of trachoma is the preschool and school child. In endemic trachoma the adult cases are usually reactivated childhood trachoma. The author summarizes his experience during the years 1930-1934 in the schools of South Tunis. There was a marked decrease in the incidence of active trachoma in the children during the four years, and this was attributed to the effects of routine treatment in the schools. (Tables.)

P. J. Leinfelder.

Thygeson, Phillips. **Acute follicular conjunctivitis, Béal's type. A report of seven cases.** Arch. of Ophth., 1935, v. 13, May, pp. 853-854.

Five cases were part of a small epidemic and two were sporadic. One case is reported in detail and illustrated with a stereoscopic photograph. The chief characteristics are: acute or subacute onset with marked inflammation but little secretion, mild nonpainful preauricular adenitis, absence of inclusion bodies or pathogenic bacteria, serofibrinous secretion in which large mononuclear cells predominate, and rapid evolution. J. Hewitt Judd.

Wright, R. E. **The trachoma problem.** Brit. Jour. Ophth., 1935, v. 19, June, p. 309.

The significance of Halberstaedter and Prowazek bodies and bacillus granulosis is discussed. Most observers seem to agree that scar tissue is an essential part of untreated trachoma. In a normal human volunteer who had been inoculated with "trachoma" material, and who developed a trachomatoid condition, the author noted after spontaneous recovery so little scar tissue that it could be made out only by use of the corneal microscope. He treats all trachomatoid cases, if without corneal complications, with lavage until he feels they must be treated as trachoma. D. F. Harbridge.

6. CORNEA AND SCLERA

Audéoud-Naville, A. **A case of deep pustuliform keratitis.** Arch. d'Opht., 1935, v. 52, May, p. 289.

The left eye of a man aged twenty-seven years was violently affected by this disease eight days after having caustic soda splashed into it. Four and a half months later the right eye became similarly affected. Deeply situated in the corneal parenchyma were irregular foci of various sizes that appeared to be pustules. The patient was luetic and had had several courses of treatment without effect on the serologic reactions. The aqueous gave a positive gold curve reaction. The left eye improved after spontaneous perforation of the cornea, the right eye after paracentesis. In each eye the disease ran a long course and left dense scars. After analyzing the literature the author concludes that traumatism is an exciting cause but syphilis the underlying one. (Illustrations, bibliography.)

Derrick Vail.

Barrada, M. A. **A case of herpes zoster ophthalmicus.** Bull. Ophth. Soc. of Egypt, 1934, v. 27, p. 107.

A case of herpes zoster ophthalmicus is reported with discussion of the etiology, complications, and pathology of the disease, which is extremely rare in Egypt. In discussion another case in a child of four years was reported.

Edna M. Reynolds.

Biernacka-Biesiekierska, J. **The correlation of the optical properties of the cornea.** Klinika Oczna, 1935, v. 13, pt. 1, p. 16.

This is a graphic report of the measurements of 1,000 eyeballs, showing the relation between corneal diameter, radius, index of curvature, and the prominence of the eyeball. A long corneal radius is usually associated with a large diameter. Small corneas are more convex than large ones. The longer the corneal radius the more prominent the eyeball. The prominence of the eyeball is closely related to its structure and to the corneal diameter.

Ray K. Daily.

Brown, E. V. L., and Katz, D. **Salzmann's nodular corneal dystrophy; its pathology and a suggested therapy.** Arch. of Ophth., 1934, v. 13, April, pp. 598-613; also Trans. Amer. Ophth. Soc., 1934, v. 32, p. 110.

The case of a woman aged twenty-four years is presented in great detail and is illustrated by photomicrographs of the nodules. No definite etiologic factor has as yet been established, but invariably the corneas show changes of previous phlyctenular keratitis. The histopathologic changes vary greatly in nodules from different individuals and in nodules from the same individual. These variations may represent different stages of the same disease. At present the only successful treatment is surgical removal.

J. Hewitt Judd.

Cepero, G., and Comas, C. **Diathermy in treatment of corneal ulcers.** Rev. Cubana de Oto-Neuro-Oft., 1935, v. 4, Jan.-Feb., p. 15, March-April, p. 48.

On the basis of forty-eight cases treated the authors note shortening of the period of treatment and smoother healing.

M. Davidson.

Dascalopoulos, N. **Treatment of purulent ulcer by galvanopuncture of the cornea.** Ann. d'Ocul. 1935, v. 172, July, pp. 467-473.

Nine cases of severe corneal ulcer were successfully treated by opening the anterior chamber with the galvanocautery. If the ulcer was centrally situated the puncture was made peripherally in healthy corneal tissue. If the ulcer was near the limbus the ulcer itself was punctured. The author regards the good results of the procedure as due to hypotony. Infection of the lacrimal sac should not be neglected but its importance is secondary to that of the galvanopuncture.

John C. Long.

Fahim, Fayek. **Treatment of corneal opacity with subconjunctival injections of dionin.** Bull. Ophth. Soc. of Egypt, 1934, v. 27, p. 93.

Thirteen cases of corneal opacity treated with subconjunctival injections of dionin are reported. A solution of two to five percent dionin either in distilled water or in a solution of 1 to 5,000 mercuric cyanide was used in

doses of from two to eight minims. Two- to three-minim doses of a two percent solution were used at first and both the strength and the amount injected were gradually increased. The injections were given at five to seven day intervals. Results were excellent in all cases but one which was complicated by a corneal ulcer.

Edna M. Reynolds.

Filatov, V. P. **Transplantation of the cornea.** Arch. of Ophth., 1935, v. 13, March, pp. 321-347.

Transplantation of the whole cornea has been done in seven cases, but the results are still unsatisfactory. In one case the cornea was transplanted with the ciliary body and iris. The author's method of partial penetrating transplantation is discussed and illustrated with drawings. The transplant is cut with a special 4-mm. trephine which is fitted with a spatula to prevent injury to the lens and prolapse of the vitreous. The histologic findings in a globe in which the transplant had been transparent for three years are presented and illustrated by photomicrographs. Fourteen successfully operated cases are reported and illustrated by photographs. J. Hewitt Judd.

Heath, Parker. **Lipin interstitial keratitis.** Arch. of Ophth., 1935, v. 13, April, pp. 614-619; also Trans. Amer. Ophth. Soc., 1934, v. 32, p. 95.

This condition of deep interstitial fat and cellular infiltration of the cornea is usually chronic, painless, and, unless treated early, bilateral. Corneal sensibility may be diminished and an aplastic uveitis may be present. This keratitis usually results as an overwhelming lipid cellular response to a mild activating lesion, probably because of constitutionally faulty fat metabolism. Treatment should be aimed at removing possible activating agents, general care, and insistence upon a low fat-carbohydrate diet. Spontaneous recovery may occur. (Photographs, color plates.)

J. Hewitt Judd.

Ivanov, E. **Primary fatty degeneration of the cornea.** Sovietskii Viestnik Opht., 1935, v. 6, pt. 3, p. 395.

To the six cases reported in the literature the author adds another, with detailed description of the slitlamp appearance and of the histology of a piece excised for biopsy. The lesion is attributed to a disease of the adrenal cortex, which causes disturbance of fat metabolism, with a deposit of fat in the cells of the corneal stroma.

Ray K. Daily.

Kirwan, E. W. O'G. **Blue sclerotics.** Proc. All-India Ophth. Soc., 1933, v. 3, pp. 89-94.

Blue sclerotics are uncommon in India, the author having seen only two cases in a wide experience. An extensive review of the literature accompanies two typical case reports.

Lawrence G. Dunlap.

Kirwan, E. O'G. **Epidemic superficial punctate keratitis in Bengal.** Proc. All-India Ophth. Soc., 1933, v. 3, pp. 1-13.

The disease appeared during the rains of 1932 and the monsoon of 1933. The author reports 1,512 cases characterized by acute inflammation, usually monocular, the preauricular glands being enlarged in the very severe forms but usually not in the milder types. Occasionally the corneal spots were vesicular. The duration of the disease was one to two weeks. Bacillus xerosis and staphylococcus albus were the only organisms found in 171 cases investigated. The pathology showed epithelial degeneration. Lawrence Dunlap.

Kiselava, E. **Tuberculin in the treatment of tuberculous lesions of the anterior segment of the eyeball.** Sovietskii Viestnik Opht., 1935, v. 6, pt. 3, p. 373. (See Section 7, Uveal tract, sympathetic disease, and aqueous humor.)

Lamb, H. D. **Corneal corpuscles in the reaction of hypersensitiveness.** Amer. Jour. Ophth., 1935, v. 18, July, pp. 644-646.

Marchesini, Ettore. **A clinical contribution to deep central interstitial keratitis.** Ann. di Ottal., 1935. v. 63, May, p. 321.

This monocular case was characterized by a series of circular central opacities gradually merging into a dense leucoma which remained after the inflammatory symptoms had disappeared. There was little sensitiveness or photophobia, but a brief period of superficial ulceration which promptly healed. The author discusses differential diagnosis but finds no explanation of his case. (Bibliography.) Park Lewis.

Melik-Musian, B. **Surgery of pannus.** Sovietskii Viestnik Opht., 1935, v. 6, pt. 3, p. 409.

The author's operation consists in introducing a continuous overcast catgut suture 2 or 3 mm. from the limbus, raising a roll of conjunctiva. During the first postoperative days this roll of conjunctiva is swollen and congested and causes an increase in the subjective symptoms. Seven to eight days later the cornea begins to clear, the catgut absorbs leaving a round cicatrix, and vision improves. The operation gave very satisfactory results in thirty-five cases. Ray K. Daily.

Michaïl, D. **Primary calcareous degeneration of the cornea.** Arch. d'Opht., 1935, v. 52, April, p. 247.

A man aged fifty-three years had suffered a small injury to the right eye a month earlier. The ensuing local irritation was followed by progressive and concentric opacification of the cornea. A portion excised at the limbus showed, microscopically, swelling and proliferation of the conjunctival vascular endothelium but absence of any sign of inflammation. Biomicroscopically the corneal opacification was seen to be due to incrustation of the parenchyma by numerous calcareous granules, which extended as far as the limbus in close association with the vessels of the region. A small number of oily granules accompanied the calcareous conjunctival granules. The blood cholesterin was 1.90 mg. per 1,000 c.c. (Illustrations, bibliography.)
Derrick Vail.

Padovani, S. **The favorable action of sodium taurocholate in trachoma.** Rev. Internat. du Trachome. 1935, v. 12, April, p. 94.

The author reports two cases of trachoma that were healed by instillations of 3, 5, or 10 percent sodium taurocholate. Improvement in corneal ulcer and pannus was noteworthy. The author believes that the salt may have a lytic effect on the inclusions.
P. J. Leinfelder.

Padovani, S. **Ophthalmic zoster and varicella.** Lettura Oft., 1934, v. 11, Dec.

Herpes zoster ophthalmicus occurred in a man aged seventy-five years. During the twenty-one days after appearance of the zoster, among the visitors in the home of the patient was a baby niece of ten months. On the twenty-third day after the zoster had appeared the baby developed varicella. It was assumed that the incubation period of the varicella in this case was from fifteen to twenty-one days. The circumstances of the location and association of the patients and the time of appearance of the zoster and the varicella were considered as evidence of contagion. Brief explanations are made of the debated question of the identity of the virus according to the hypothesis of Bokay. (Bibliography.) F. M. Crage.

Riehm, W. **Passive anaphylaxis of the cornea. Allergy against horse serum in parabiotic rabbits.** Arch. f. Augenh., 1934, v. 108, June, p. 447.

The author's introduction summarizes the contents of papers by Hofe and by Krantz and Hofe on the same subject (Archiv für Augenheilkunde, 1933, volume 108, page 246; and Klinische Wochenschrift, 1933, volume 12, page 695). Parabiotic rabbits are rabbits which have been united surgically by their abdominal cavities, one of them having been prepared by injection of horse serum while the other was not so prepared. Positive transmission of an anaphylactic reaction from the one animal to the other was not demonstrable.

The weakness of present theories to explain elective tissue sensitization induces the author to elaborate his own

theory. Anaphylactic inflammation is produced by the body cell itself along reflex paths. This process is released whenever a foreign antigen reacts with an antibody which is not detachable from the body cell. Not all serologically demonstrable antibodies play a part in the anaphylactic reaction. To transmit to a normal animal a readiness for anaphylactic reaction one must inject blood or serum which contains an adequate amount of antibodies, the latter becoming effective in the receiving animal only if they become sessile in body cells previously free from antibodies. Through formation of antibodies the organism defends itself against invading anaphylactogens by destroying and eliminating them. If it is successful in doing so we speak of immunity. Since the formation of detachable antibodies is quantitatively exhaustible, immunity can be only relative. If the demand is too great, the detachable antibodies will become insufficient for destruction of the antigens and the cell itself will be harmed, and by reflex paths it will produce the so-called anaphylactic inflammation. If the amount of antigen in the blood is not too great, only a local reaction will occur; with higher concentration of anaphylactogen in the blood, a whole organ will react (for instance an artificially and electively sensitized organ). In case of massive invasion by anaphylactogens all the organs of the body may take part in the reaction.

R. Grunfeld.

Rostkowski, L. **A forceps for Denig's operation.** Klinika Oczna, 1935, v. 13, pt. 1, p. 161. (See Amer. Jour. Ophth., 1935, v. 18, June, p. 583.)

Sandomir, I. **Two cases of disciform keratitis.** Sovietskii Viestnik Opht., 1935, v. 6, pt. 3, p. 411.

Recurrent herpes of the lips was considered the etiologic factor in the first case, and vaccine virus in the second. The author points out that the term disciform keratitis describes a clinical syndrome of varying etiology.

Ray K. Daily.

Saul, Hugo. **The fate of patients with parenchymatous keratitis.** Zeit. f. Augenh., 1935, v. 86, June, p. 199.

Of patients treated at the Kiel clinic for parenchymatous keratitis, 100 were reexamined after a period varying from thirteen to twenty-eight years. In sixteen there were severe disturbances of vision, eleven patients were practically blind, fifteen had a normal pupillary reaction without other signs of disease of the central nervous system. Thirty-five had defective hearing, thirty-one had Hutchinson teeth, ten were feeble-minded; seventy-one were capable of earning their own living. Life expectancy was not materially reduced, but possibility of reproduction was.

F. Herbert Haessler.

Searer, H. A. **Bacillus pyocyaneus keratitis.** Arch. of Ophth., 1935, v. 13, March, pp. 447-448.

Each of the three cases reported resulted from a foreign body on the cornea. Ulceration extended rapidly and necessitated enucleation. Usual treatment was of no avail. All three showed mild hyperpyrexia with relatively high leucocytosis. J. Hewitt Judd.

Selinger, E. **Local quinine therapy in cases of interstitial keratitis and old corneal opacities.** Arch. of Ophth., 1935, v. 13, May, pp. 829-832.

This preliminary report points out that quinine is a protoplasmic poison which penetrates deeply into the tissues, and when locally applied destroys leucocytes and lymphocytes and probably causes absorption of newly formed connective tissue in the cornea. Animal experimentation indicates that a four percent ointment or a ten percent aqueous solution causes no harmful effects when applied daily for many months. A two percent quinine bisulphate ointment applied twice daily has a favorable influence on the course of interstitial keratitis and promotes clearing of the opacities. J. Hewitt Judd.

7. UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

Bonnet, P., and Colrat, A. **Contribution to the chemical anatomy of inflam-**

matory tuberculosis of the iris. Arch. d'Opht., 1935, v. 52, June, p. 385.

A woman of twenty-three years showed a general calcified tuberculous adenopathy which was entirely healed, and chronic tuberculous nephritis. The right eye was affected with tuberculous iritis with hypopyon, the left eye with hypertensive iritis which led to enucleation because of glaucoma. Examination of the enucleated eye showed small scattered foci of lymphocytic infiltration in the cornea, many in the iris, few in the ciliary body and choroid, and none in the retina. The areas were filled with plasma cells and small lymphocytes. No giant or epithelioid cells were seen. There was marked perivascular infiltration throughout. The authors believe their case proves that a plastic subacute iridocylitis, with early and solid synechiae and secondary hypertension, can be considered as arising from a tuberculous process. (Illustrations, bibliography.) Derrick Vail.

Chowdhury, A. **Some cases of congenital abnormalities of the eye.** Proc. All-India Ophth. Soc., 1933, v. 3, pp. 145-147.

The author reports a case of coloboma of iris, choroid, and disc with microphthalmos; a case of aniridia with cupping of the optic disc; and a case of persistent pupillary membrane.

Lawrence G. Dunlap.

Cohen, S. J., and Rabinowitz, M. A. **Uveoparotitis.** Jour. Amer. Med. Assoc., 1935, v. 105, Aug. 17, p. 496.

A discussion of the syndrome from the medical clinician's point of view is given, with one case report. The authors conclude that no definite etiologic factor appears to be responsible, that the disease is chronic and self-limiting, that the only permanent morbidity is visual impairment, and that foreign protein therapy should be tried. George H. Stine.

Corcelle. **The meningeal reactions of sympathetic ophthalmia.** Arch. d'Opht., 1935, v. 52, May, p. 327.

Two cases of sympathetic ophthalmia, proved by pathologic study, showed meningeal reactions without symptoms. Tuberculosis and syphilis were excluded. The author concludes that in the study of sympathetic ophthalmia one should consider meningeal reactions as probably indicating passage of the causal agent by this path. (Bibliography.) Derrick Vail.

Kruskal, I. D., and Levitt, J. M. **Uveoparotid tuberculosis.** Amer. Jour. Ophth., 1935, v. 18, Aug., pp. 735-738.

Lavin, L. H. **Uveoparotid syndrome.** Trans. Ophth. Soc. United Kingdom, 1934, v. 54, p. 549. (Illustrations of sialograms of the parotid.)

Sixty-six cases from the literature are taken for comparison with that reported by the author. Tuberculous etiology has been found in the majority of cases, including each of five cases which came to autopsy.

The author's case had a weak positive Mantoux reaction, but the condition improved rapidly after drainage of both antra. Beulah Cushman.

Rossi, Giuseppe. **Permeability of the ophthalmic blood barriers in experimental anaphylaxis.** Lettura Oft., 1935, v. 12, March, p. 113.

The author studied the permeability of the ocular circulatory barriers in rabbits. After determining the albumin and refractive index of the aqueous, the rabbits were sensitized by repeated intraperitoneal injection of normal horse serum. The aqueous was again subjected to the same tests after anaphylactic shock had been produced by another injection of horse serum. There was a slight increase in the albumin and the refractive index. Fluorescein injected subcutaneously or intravenously passed into the anterior chamber more rapidly than in the control animals.

F. M. Crage.

Salit, P. W. **Sodium content of aqueous, vitreous, and serum.** Amer. Jour. Ophth., 1935, v. 18, Aug., pp. 706-708.

8. GLAUCOMA AND OCULAR TENSION

Bhaduri, B. N. **Some observations on hypotension in cholera patients.** Proc.

All-India Ophth. Soc., 1933, v. 3, pp. 158-161.

In cholera during the stage of copious evacuation and collapse there is much reduction in intraocular tension. Forty-three cases were observed. The tonometric findings may be questioned as they were made under cocaine anesthesia. The average tension was 12 mm. Hg. With recovery of the patient, tension reached a (Schiötz) normal, of 20 to 23 mm. Hg. in most of the patients.
Lawrence G. Dunlap.

Clapp, C. A. **The iris inclusion operations for glaucoma, with especial reference to iridotasis.** Trans. Amer. Ophth. Soc., 1934, v. 32, pp. 191-208.

The author reviews the history and discusses in detail the technique involved. He regards these operations as producing satisfactory reduction of tension in a greater percentage of cases than any other operative procedure for glaucoma. (Discussion.)
C. Allen Dickey.

Dunphy, E. B. **Glaucoma accompanying nevus flammeus.** Amer. Jour. Ophth., 1935, v. 18, Aug., pp. 709-714; also Trans. Amer. Ophth. Soc., 1934, v. 32, p. 143.

Evans, J. J., and Evans, P. J. **Etiology and treatment of congestive glaucoma.** Trans. Ophth. Soc. United Kingdom, 1934, v. 54, p. 527.

The author reviews the chemical and vascular theories of glaucoma, and reports the use of acetylcholin in acute glaucoma, by subconjunctival or intramuscular injection and in conjunction with eserin. The action of the drug is evanescent, but aids in the reduction of high tension and therefore diminishes postoperative complications, such as choroidal and retinal detachment and hemorrhage. Beulah Cushman.

Gradle, H. S. **A critique of glaucoma operations.** Amer. Jour. Ophth., 1935, v. 18, Aug., pp. 730-735.

Rossi, G. **Ocular tension in guanidine tetany.** Lettura Oft., 1935, v. 12, April, p. 147.

The behavior of the intraocular tension was observed in rabbits and dogs brought to a convulsive state by subcutaneous injections of hydrochloride of guanidine. There was almost always a slight but evident hypotony synchronous with the development of the convulsive phenomena. Referring to previous researches on ocular tension in the syndrome accompanying absence of the parathyroid, the author concludes that the tetanic state in animals is accompanied by moderate lowering of ocular tension. The marked hypotony met with in parathyroidectomized dogs is attributable chiefly to the dystrophic factors which follow suppression of parathyroid function. F. M. Crage.

Sanguinetti, C. **Glaucoma and cataract.** Lettura Oft., 1934, v. 11, Nov., p. 542. (See Section 9, Crystalline lens.)

9. CRYSTALLINE LENS

Daniel, R. K. **Allergy and cataracts.** Jour. Amer. Med. Assoc., 1935, v. 105, Aug. 17, p. 481.

The three cases here reported not only fall into the group "opacification of the lens in young adults accompanied by skin manifestations," but further, by virtue of the history and the positive allergic reactions observed, the condition could be termed "allergic cataract," or, perhaps more correctly, "cataract associated with allergy." (Discussion.)
George H. Stine.

Davis, A. E. **The medical treatment of senile cataract.** Trans. Amer. Ophth. Soc., 1934, v. 32, pp. 64-95.

This paper discusses the etiology of senile cataract, and the bearing of permeability of the lens capsule on the medical treatment of cataract. The author advises removal of all foci of infection, and subcutaneous injections of lens antigen every other day, or twice weekly, until fifty are given. He believes the lens antigen produces cytolysins which penetrate the lens capsule, and so arrest or cure the cataract. (Discussion.) C. Allen Dickey.

Fazio, F. **Research on dehydrogenative processes of the crystalline lens af-**

ter **irradiation with infrared rays.** Ann. di Ottal., 1935, v. 63, May, p. 370.

In this study the author followed the method of Thunberg in experiments on rabbits. Twenty-four hours after irradiation the dehydrogenative processes were moderately increased, while successively from the second to the seventh day there was a notable reduction which gradually lessened until the tenth day, when the normal was again established. (Bibliography.) Park Lewis.

Gabriélidès, A. **Contribution to the study of electric cataracts.** Arch. d'Opht., 1935, v. 52, June, p. 394.

An electrician attempted suicide by grasping an electric wire carrying 5,500 volts. Eleven months later he was found to have anterior subcapsular lens opacities in the region corresponding to the pupillary area. It is rare for cataract to develop when the electric contact with the body is so far from the eyes. The author studied twenty-seven case reports from the literature and appends an interesting table of analysis. The cataracts are always anterior subcapsular and show irregular white spots on the anterior capsule, due to exuberant proliferation of epithelial cells. As a rule the opacity is late in developing (1 to 19 months). Glassblower and x-ray cataracts are posterior. (Illustrations, table, bibliography.) Derrick Vail.

Horner, W. D., Jones, R. B., and Boardman, W. W. **Cataracts following the use of dinitrophenol. Preliminary report.** Jour. Amer. Med. Assoc., 1935, v. 105, July 13, p. 108.

In three cases dinitrophenol had been used as a weight reducer, and the ages of the patients and the absence of other external or physical factors suggested this drug as the cause. In all three patients there were posterior subcapsular opacities resembling brass filings, together with faint powdery anterior subcapsular changes. Two of the three had a peculiar dried appearance of the anterior capsule, and development of the lens changes was remarkably rapid, suggesting the swift changes seen in frank traumatic cataract. The effect of dinitrophenol may be toxic, metabolic, or dietetic. The authors recommend that use of dinitrophenol be discontinued pending further study of its secondary systemic effects.

George H. Stine.

Knapp, A. **Intracapsular operation for cataract. Report on a fifth hundred successive extractions.** Arch. of Ophth., 1935, v. 13, May, pp. 823-828.

The cataracts were extracted by tumbling in eighty-nine cases, head-on in three, and in eight the lens was drawn out with the forceps remaining in situ. Healing was complicated by prolapse of iris in two cases, by hyphemia in nine, and by vitreous loss in five. The vision was 20/20 in fifty cases, 20/20 minus in five, 20/30 in twenty-two, and 20/30 minus in three. Death occurred in three cases, and in thirteen the imperfect visual results were due to conditions not related to the operation. One case developed retinal detachment and three a deep keratitis, with slow restoration of the anterior chamber, cyclitis, and secondary glaucoma. J. Hewitt Judd.

Lloyd, R. I. **Arachnodactyly (Marfan's syndrome).** Arch. of Ophth., 1935, v. 13, May, pp. 744-750; also Trans. Amer. Ophth. Soc., 1934, v. 32, p. 361.

The previously reported findings are summarized and six cases are reported. Five were in one family, the mother and four children having typical findings while the father and two children escaped. Two had tapetoretinal degeneration and two had spina bifida occulta. None had congenital heart disease. This familial and hereditary disease is probably more common than supposed, as mild and atypical cases may escape notice. (Photographs.)

J. Hewitt Judd.

Morard, G. **Arachnodactyly and bilateral ectopia lentis.** Arch. d'Opht., 1935, v. 52, May, p. 344.

A boy of ten years showed symmetric dislocation of each lens upward and outward. He was a true arachnodactylic, but there was no history of familial involvement. Analyzing the literature the author found that 57.4 percent of arachnodactylics showed

ectopia lentis. He does not agree with any of the current theories regarding etiology, but is inclined to support Ida Mann's idea that the basis lies in chromosomal linking between genes governing certain regions of the eye and other parts of the body. (Illustrations, bibliography.) Derrick Vail.

Moreu, Angel. **Intracapsular extraction of the crystalline lens with electrodiaphakia.** Amer. Jour. Ophth., 1935, v. 18, Aug., pp. 739-743.

Rochon-Duvigneaud, A. **Structure and form of the lens.** Ann. d'Ocul., 1935, v. 172, July, pp. 563-587.

This is a detailed discussion of the factors concerned in the structure of the crystalline lens. In the lenses of some birds and reptiles the fibers come together at points at the front and back of the lens, the fibers becoming thinner as they approach the poles. In species with linear sutures this thinning is much less apparent, and there is even less thinning in lenses with Y-shaped or star-shaped sutures. Some of the factors are unknown. John C. Long.

Sanguinetti, C. **Glaucoma and cataract.** Lettura Oft., 1934, v. 11, Nov.

Five cases of glaucoma with cataract are reported. The author made the following recommendations: In the presence of chronic glaucoma well controlled by miotics, cases having mature cataract should be operated upon by combined extraction. If miotics do not help, extraction should be preceded by scleroiridectomy. In chronic glaucoma with immature cataract, if the tension can be kept normal by miotics, extraction may be postponed. In cases previously operated upon by sclerectoiridectomy it is recommended that the incision for extraction end in the cornea and not at the limbus or beyond it as in uncomplicated cases.

F. M. Crage.

Shutes, M. H. **Dinitrophenol.** Amer. Jour. Ophth., 1935, v. 18, Aug., p. 752.

10. RETINA AND VITREOUS

Bagchi, S. K. **A case of retinal exudate which cleared up after antiamebic treatment.** Proc. All-India Ophth. Soc., 1933, v. 3, pp. 82-83.

The author describes a retinal exudate with no pigmentary changes or evidence of retinal hemorrhage. Living amebae and cysts were found in the stools. After five months of antiamebic treatment the exudate had disappeared completely but there was no visual improvement. Lawrence G. Dunlap.

Banerjii, G. **Hemorrhagic retinitis in young persons.** Proc. All-India Ophth. Soc., 1933, v. 3, pp. 76-79.

The author reported three cases, one each following constipation and syphilis, syphilis alone, and a familial history of tuberculosis. All were between the ages of twenty and thirty years, had prodromal misty vision, hemorrhage from the peripheral veins of the retina, rapid absorption of blood from the vitreous, and recurrent attacks.

Lawrence G. Dunlap.

Biswas, P. K. **A case of central retinitis due to infected antrum.** Proc. All-India Ophth. Soc., 1933, v. 3, pp. 80-81.

The case was of two weeks duration. The left fundus was pathologic only in the macular region, there being a cherry-red spot in the fovea with a few white spots without pigmentation around it. The right eye showed a few white spots around the macula without pigmentation. The only other pathologic finding was a left antrum full of pus, and this was drained with visual improvement in four days and ultimate vision of 6/9 in each eye. The cherry-red spot in the fovea of the left eye was considered physiologic, as scotometric examination showed no central scotoma. Lawrence G. Dunlap.

Hay, P. J. **A new operation for detachment of the retina.** Trans. Ophth. Soc. United Kingdom, 1934, v. 54, p. 613.

In a patient of twenty-four years with detachment in the outer lower quadrant, a 1.5 mm. trephine opening was made 12 mm. from the cornea and another opening 1.5 mm. from the first. A curved advancement needle armed with no. 1

silk was passed from one trephine opening to the other, leaving about 10 mm. of the thread hanging out at each end. The conjunctiva was sutured and the ends of the silk drain left buried underneath. After two weeks in bed the silk was removed. The retina had remained in place to the date of report. In another case two sutures were passed.

Beulah Cushman.

Heuven, J. A. van. **The water-binding of the retina.** Brit. Jour. Ophth., 1935, v. 19, July, p. 390.

The retina is a swelling gallert with a not unimportant capacity of water-binding. In acids, except in phosphoric acid, the swelling is checked. Alkalies promote but salts check the swelling. The rate of swelling is less and the exsiccation time slower than that of any other tissue of the globe. All the water is loosely bound, which is not the case in any other tissue of the globe.

D. F. Harbridge.

Hippel-Lindau disease. Government Ophthalmic Hospital, staff of (Madras). Proc. All-India Ophth. Soc., 1933, v. 3, pp. 84-88.

Hippel's disease appears rare in southern India, only three cases having been recorded in 250,000 patients. Two were seen early and were followed carefully for five years. Four colored plates show the progressive stages of (a) aneurismal sac; (b) petechial hemorrhages and macular stippling of retinitis; (c) retinal edema, more hemorrhages, and perimacular crescentic dense white band of flocculent material; and (d) many vitreous floaters of hemorrhage. All three cases were confined strictly to the retinal vessels on one side, and there were no evidences of a familial nature, nor of affection of central nervous system or skin.

Lawrence G. Dunlap.

Kronfeld, P. C. **Histologic appearance of recent retinal tears.** Arch. of Ophth., 1935, v. 13, May, pp. 779-790.

The right eye of a man aged fifty-four years was enucleated three months after onset of an idiopathic detachment. Numerous tears had been present and the retina had not become reattached after electrocoagulation. New tears and further detachment apparently had developed only a few days before removal of the eye. The histologic changes at the site of operation and in the region of the new tears are described and are illustrated by photomicrographs. The findings show clearly how a retinal tear may develop from an atrophic retinal lesion resulting from retinochoroiditis. However, two spindle-shaped tears apparently were caused by either vitreous traction, a shrinking within the retina, or disturbed equilibrium of hydrostatic pressure. The necrosis of the sclera at the site of the cautery punctures was only partly repaired after two and a half months.

J. Hewitt Judd.

Tansley, Katharine. **The production of rosettes in the mammalian retina.** Trans. Ophth. Soc. United Kingdom, 1934, v. 54, p. 566. (See Amer. Jour. Ophth., 1933, v. 16, Sept., p. 848.)

Beulah Cushman.

Veil, P., Dollfus, M. A., and Desvignes. **Pathologic anatomy of so-called idiopathic detachment of the retina.** Arch. d'Opht., 1935, v. 52, May, p. 307.

Five days after galvanopuncture for retinal detachment, the patient died as a result of acute intestinal obstruction. The examined eye showed large areas of vacuolar degeneration, but the layer of rods and cones was little altered, although the detachment was of one month duration. The vitreous was adherent to the operative site. It was also retracted behind the lens and the retinal detachment, but only more numerous examinations of recent cases will determine if this effect is due to fixation. (Illustrations.)

Derrick Vail.

Wood, D. J. **Observations on the human retina.** Brit. Jour. Ophth., 1935, v. 19, July, p. 369.

The author has studied the posterior segments of two normal eyes, with eight excellent photomicrographs. He fails to find any grouping arrangement between the bipolar cell and next neuron, unless this is subserved by the laminated arrangement of the dendrites in the inner molecular layer. He traces the Mueller

fibers at the disc margin back into the neuroglia in the anterior part of the lamina cribrosa. In longitudinal sections the bundles divided and rearranged themselves into different bundles, doubtless with reference to retinal areas, as is well known in the case of the macular bundle.

D. F. Harbridge.

11. OPTIC NERVE AND TOXIC AMBLYOPIAS

Carroll, F. D. **Cerebrospinal-fluid studies in ten cases of tobacco-alcohol amblyopia.** Amer. Jour. Ophth., 1935, v. 18, Aug., pp. 720-723.

Lauber, Hans. **The formation of papilledema.** Arch. of Ophth., 1935, v. 13, May, pp. 733-743.

The author reviews the theories of the mechanism of papilledema and reports the results of studies on the relation of retinal arterial to retinal venous pressure and of intracranial pressure to the retinal arterial and venous pressure as measured by the ophthalmodynamometer of Sobanski. These findings indicate that a low diastolic pressure in the retinal arteries with normal intraocular tension and simultaneous rise of retinal venous pressure are the chief factors in the formation of papilledema. (Photomicrographs.)

J. Hewitt Judd.

Margaritella, Riccardo. **Clinical and experimental contribution to the use of strychnine in certain ocular affections.** Lettura Oft., 1935, v. 12, Feb., p. 51.

Subconjunctival injections of ethyl strychnine, in dosage of 1 to 3 cg., were administered to patients having toxic amblyopia and optic atrophy from lues or nasal sinusitis, with one case of bilateral internal ophthalmoplegia. The very satisfactory results obtained were attributed to the strychnine, which as ethyl strychnine could be given in large doses. The drug had been tested for toxicity on experimental animals.

F. M. Crage.

Weskamp, C. **Optic atrophy and malaria therapy.** Ann. d'Ocul. 1935, v. 172, June, pp. 449-457.

Of 16 cases of luetic optic atrophy treated by inoculation with malaria, eight showed improvement, five had remissions, two became worse, and in one case the course was doubtful. The results were judged by studies of visual acuity and fields for at least three years after the malaria had been given. In addition to the malaria the patients received arsenic, mercury, bismuth, and atropin.

John C. Long.

12. VISUAL TRACTS AND CENTERS

Clothier, J. V. **Return of symptoms after successful removal of a pituitary tumor. Complete restoration of central and perimetric vision by medical treatment.** Arch. of Ophth., 1935, v. 13, May, pp. 819-822.

A woman aged fifty-five years again noticed failing vision six years after subtotal removal of a chromophobe adenoma of the pituitary. Vision was completely restored after using potassium iodide and desiccated thyroid for six months, and has remained normal for a year. (Perimetric charts.)

J. Hewitt Judd.

Gjessing, H. G. A. **The importance of eye symptoms in the diagnosis and localization of brain tumors.** Trans. Ophth. Soc. United Kingdom, 1934, v. 54, p. 581.

An historical survey of brain localization is given, from Paul Broca's work in 1861 through Hughlings Jackson, the Nestors, Horsley, Macewen, and Ballance to Cushing. The author emphasizes the need of frequent visual field study in patients with severe headache. A survey of the eye symptoms and visual field defects with different types of brain tumor is given, with the findings according to anatomic location.

Beulah Cushman.

Magoun, H. W., and Ranson, S. W. **The central path of the light reflex. A study of the effect of lesions.** Arch. of Ophth., 1935, v. 13, May, pp. 791-811.

The innervation of the pupillary sphincter was investigated as to the effect on the light reflex of small, accurately placed lesions made with the Horsley-Clarke instrument. It is found

that after leaving the brachium of the superior colliculus the pupillomotor fibers turn rostromedially and enter the pretectal region. After partial decussation in the posterior commissure they arch ventrally around the rostral end of the central gray matter of the aqueduct, with partial ventral decussation, to reach the rostral portion of the oculomotor nucleus. In bilateral lesions the amount of reduction in the light reflex is proportional to the amount of the pretectal region involved. The locations of the various lesions are shown by diagrams. J. Hewitt Judd.

Magoun, H. W., and Ranson, S. W. **The afferent path of the light reflex. A review of the literature.** Arch. of Ophth., 1935, v. 13, May, pp. 862-874.

The reported observations are correlated anatomically for each portion of the brain stem, starting with the optic nerve and proceeding centrally. On this basis the course is found to run centrad in the optic tract and superior quadrigeminal brachium to the pretectal region, where it swings vertically around the central gray matter enclosing the rostral end of the cerebral aqueduct to reach the oculomotor nucleus. The pathway undergoes partial decussation in the posterior commissure and again somewhere ventral to the central gray matter. The superior colliculus is not concerned with the pupillary light reflex. J. Hewitt Judd.

13. EYEBALL AND ORBIT

Cazalis, R., and Duguet, J. **Unilateral exophthalmos due to compression of the cervical sympathetic.** Arch. d'Opht., 1935, v. 52, June, p. 440.

A woman of twenty-seven years had shown left exophthalmos since birth. Occasional increase in proptosis followed heavy physical labor and was associated with intense salivation and nausea; the exacerbation lasted five to seven days. When seen by the author there was marked proptosis of the left eye due to retrobulbar hemorrhage, which increased in a few days until the eye became immovable. X-ray showed marked hypertrophy of the epiphysis of the seventh cervical. The pupils were always equal and reacted normally, a fact which the author explains by the pressure affecting only the communicating branch of the eighth cervical and not the ganglion. The exacerbations are explained by bending of the neck during physical labor. The retrobulbar hemorrhage consisted of blood which did not coagulate after standing twelve days. It was coincident with menstrual disturbance and the author regarded it as of genital origin. (Illustrations.)

Derrick Vail.

Cohen, M., and Scarff, J. E. **Unilateral exophthalmos produced by a meningioma of the middle cranial fossa.** Arch. of Ophth., 1935, v. 13, May, pp. 771-778.

In a boy aged seventeen years, a meningioma arising in the middle cranial fossa produced slowly progressive unilateral exophthalmos associated with ophthalmoplegia, primary optic atrophy, and hyperplastic thickening of the posterior orbital plate demonstrable by x-ray. The tumor was removed with only slight improvement of the exophthalmos. Because of the slow rate of growth of these tumors prognosis is favorable regarding life, but not so favorable regarding vision, since the tumor has usually invaded the bony margins of the optic foramen and the sphenoidal fissure when first seen. The clinical and pathologic features of this syndrome are discussed.

J. Hewitt Judd.

King, Clarence. **A case of chloroma with orbital involvement benefited by x-ray therapy.** Trans. Amer. Ophth. Soc., 1934, v. 32, pp. 340-353.

When first seen, a boy aged nine years had marked left exophthalmos with a palpable mass in the outer extremity of the upper lid. Because of the blood picture and cranial involvement, a diagnosis of chloroma was made. Six x-ray treatments given every other day resulted in almost complete subsidence of the exophthalmos, with return of complete motility, although the boy died later from general manifestations of the disease. The author urges that

no radical procedure be adopted until other methods have failed. (Discussion.) C. Allen Dickey.

Plummer, W. A., and Wilder, R. M. **Etiology of exophthalmos. Constitutional factors, with particular reference to exophthalmic goiter.** Arch. of Ophth., 1935, v. 13, May, pp. 833-852. (See Amer. Jour. Ophth., 1935, v. 18, July, p. 684.)

Ray, N. N. **Septic thrombosis of the cavernous sinus and orbital cellulitis.** Proc. All-India Ophth. Soc., 1933, v. 3, pp. 138-141.

Five cases of sinus thrombosis showed paralysis of the external rectus muscle and were ultimately bilateral; whereas orbital cellulitis, of which one case report is given, is almost always unilateral and usually recovers. In one case here reported, neglected orbital cellulitis developed into cavernous sinus thrombosis and the patient died. The classical symptom of edema over the mastoid of the affected side was absent in all of the reported cases of cavernous sinus thrombosis.

Lawrence G. Dunlap.

Reese, A. B. **Dacryoadenitis in hyperthyroidism.** Arch. of Ophth., 1935, v. 13, May, pp. 855-857. (See Section 14, Eyelids and lacrimal apparatus.)

14. EYELIDS AND LACRIMAL APPARATUS

Chakravarti, J. **Pitfalls in the extirpation of the lacrimal sac.** Proc. All-India Ophth. Soc., 1933, v. 3, pp. 134-137.

The author recounts complications he and others have had during extirpation of the lacrimal sac.

Lawrence G. Dunlap.

Das Gupta, D. C. **Observations on a case of Mikulicz' disease.** Proc. All-India Ophth. Soc., 1933, v. 3, pp. 148-149.

There was chronic symmetric enlargement of the lacrimal and salivary glands with very little disturbance of general health. The left eyeball was proptosed and deviated down and in, with lagophthalmos, perforating ulcer, prolapsed iris, and panophthalmitis. The orbit was eviscerated. The swelling of the salivary glands began to disappear after removal of the lacrimal glands, and the patient was discharged cured after about four months.

Lawrence G. Dunlap.

MacDonald, A. E. **Stereoscopic photograph of lacrimal sac after injection with thorium dioxide.** Trans. Amer. Ophth. Soc., 1934, v. 32, pp. 398-399.

In a case of chronic dacryocystitis thorium dioxide was injected and stereophotographs taken. These showed the constriction to be in the nasolacrimal duct. The condition was relieved by removal of part of the inferior turbinate.

C. Allen Dickey.

Rambo, V. C. **The place of tarsectomy and mucous membrane grafting in surgery of the upper lid and conjunctiva.** Proc. All-India Ophth. Soc., 1933, v. 3, pp. 120-125.

A modified Duverger and Velter operation is described to deal with those (East) Indians who cannot or will not submit to prolonged treatment for trachoma. The upper lid tarsus is resected to the upper border, preserving the upper margin with the levator muscle attached. A mucous membrane graft from the lip is sutured into the defect. This mucous membrane does not become trachomatous.

Lawrence G. Dunlap.

Reese, A. B. **Dacryoadenitis in hyperthyroidism.** Arch. of Ophth., 1935, v. 13, May, pp. 855-857.

The extraocular muscles and lacrimal glands were examined in progressive exophthalmos following thyroidectomy in two patients whose postoperative basal metabolic rate was minus. The muscles showed typical degeneration, edematous fibrosis, and cellular infiltration. The glands showed these same histologic changes. (Photomicrographs.)

J. Hewitt Judd.

NEWS ITEMS

Edited by Dr. H. Rommel Hildreth
640 S. Kingshighway, St. Louis

News items should reach the Editor by the twelfth of the month.

Deaths

Dr. William H. Wilder, Chicago, died September 24, aged 74 years.

Dr. Henry Lincoln Wolfner, St. Louis, died July 11, aged 74 years, of chronic myocarditis.

Dr. Calvin C. Rush, Johnstown, Pa., died July 19, aged 59 years, of subacute bacterial endocarditis.

Miscellaneous

Dr. E. C. Ellett writes the following account of the Pan-American Medical Congress.

The Pan-American Medical Congress was held on the S.S. "Queen of Bermuda" sailing from New York on June 29 and returning August 2. The destination was Rio de Janeiro and São Paulo, in Brazil, and several stops were made at West Indian ports. There were 125 doctors on board and among them the following ophthalmologists: Emory Hill, W. P. Eagleton, J. L. Sanders, E. C. Ellett, A. J. Streit, E. G. Ferguson, W. Y. Sayad, W. A. Kreiger, John O. McReynolds, A. S. Green, and Otis Wolfe. Each one of these contributed to the program, some more than once. The attempt to meet in sections was abandoned after the first day and thereafter all met together. Usually two sessions a day were held, and this, with the social features of the cruise, made the time pass very quickly.

Apart from our own contributions, ophthalmology was sadly neglected. One section meeting in São Paulo, with two papers, and some pictures of cataract extraction by Dr. McReynolds at a general session, was the extent of it. The two papers were on "Tuberculosis" and the "Trachoma problem in Brazil," respectively. The first was read in Portuguese, rapidly and not loudly, so that "we others" did not understand a word of it. After a few muttered words in Portuguese by the chairman, which we afterwards heard was a call for discussion, the next paper was read, and though summarized in English, was about as interesting as the infantile paralysis problem in North Carolina would be to the Brazilians. Two of our members had prepared discussions on tuberculosis, and one of them was written in French as well as in English in an effort to make it intelligible to the Brazilians, but no opportunity was given to present our material. No eye clinic was held, though two of us were asked to see an operation. There is a large leper hospital in São Paulo, with a ward devoted to eye cases, but we heard of that only after the boat had sailed.

The social aspects of the cruise will be dealt with by others, as this account concerns only the ophthalmological activities. An excellent program on Tuberculosis, and an interesting demonstration on various subjects were arranged at Puerto Rico, but nothing of special interest to those concerned with the eye. At the meetings on the ship, papers were presented on Glaucoma, Cataract, Ophthalmic surgery, and Tumors of the eye and orbit, abundantly illustrated with lantern slides and moving pictures.

Interesting social features, the opportunity to see foreign countries, and exceptional advantages in getting acquainted with a very representative body of physicians made the cruise most enjoyable and profitable.

Sir James Barrett, Vice-chancellor of the University of Melbourne, Australia, has been chosen President-elect of the British Medical Association for the year 1935-36. His work at Moorfields had made him a prominent ophthalmologist before he went to Melbourne in 1889. He was knighted after the close of the World War, both for his services in the war and his activity in establishing the "Bush Nursing" system, that has done so much for isolated communities in Australia.

The Council of the Royal College of Surgeons of England has appointed Dr. A. F. MacCallan as Hunterian Professor for the ensuing year. Professor MacCallan will deliver a lecture on January 17, 1936, at the College of Surgeons, Lincoln's Inn Fields, London, on "The Surgery and pathology of trachomatous conjunctivitis."

Dr. Alix Churchill, associate secretary-general of the International Association for Prevention of Blindness and executive secretary of the International Union Against Tuberculosis, arrived August 30 aboard the S.S. "President Roosevelt" for a series of conferences throughout the United States regarding policies and procedures in the world-wide fight against blindness and tuberculosis. She is here as the guest of the National Society for the Prevention of Blindness and the National Tuberculosis Association.

The American Optical Company has purchased a substantial interest in the Spencer Lens Company of Buffalo, New York. The business of the Spencer Lens Company will continue to be operated under the same

name, personnel, and policies as at present, with executive offices and manufacturing plant at Buffalo, New York.

Societies

On account of the "International Exhibition of Brussels," the Belgian Ophthalmological Society organized a special meeting, on the 21st and 22d of September, 1935. The following lectures were given: "The physiopathology of nephritis," by Dr. Paul Govaerts, professor of medicine at the University of Brussels; "Ocular complications of nephritis," by Dr. Marcel Danis, professor of ophthalmology at the University of Brussels; "A few aspects of the relations of the hypophysis and the visual apparatus," by Dr. Jeandelize, professor of ophthalmology at the University of Nancy; "Treatment of iridocyclitis with ocular hypertension," by Dr. L. Weekers, professor of ophthalmology at the University of Liége.

Personals

Dr. C. W. Rutherford is moving from Iowa City, Iowa, to enter private practice in Indianapolis, Indiana.

Dr. John N. Evans has been tendered the Chair of Ophthalmology at the Long Island College of Medicine, recently vacated by Professor Henry Mitchell Smith.

Dr. Robert Merriam Rogers of the staff of the Long Island College Hospital has been advanced to the position of Clinical Professor of Ophthalmology at the Long Island College of Medicine.

Dr. Mortimer Lasky and Dr. Frank Mallon have been advanced to the position of Instructor in Ophthalmology at the Long Island College of Medicine.